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THE CRANFORD SITE (DlPb-2) A MULTICOMPONENT STONE CIRCLE SITE ON THE OLDMAN RIVER

Glenn S. L. Stuart

ARCHAEOLOGICAL
SURVEY
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CULTURE AND MULTICULTURALISM

THE CRANFORD SITE, DlPb-2
A MULTICOMPONENT STONE CIRCLE SITE ON THE OLDMAN RIVER

ASA Permit 87-59

Prepared for:

Alberta Transportation and Utilities
Edmonton, Alberta

By:

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January 1989

Abstract

Alberta Transportation requested that Fedirchuk McCullough & Associates Ltd. conduct mitigative excavations in the Central Area of the Cranford Site, DlPb-2, so that aggregate extraction may proceed in that portion of the aggregate lease.

The Cranford Site, a multi-component stone circle site located on the south bank of the Oldman River in south central Alberta, consists of 87 rings, 5 cairns, a rock alignment, and surface and buried lithic concentrations. The Central Area of the site consists of 38 stone circles, all of which have now been mapped and excavated. Excavation of 220 square metres during 1987 resulted in the recovery of 2944 lithic artifacts, 2772 faunal remains, and 1165 pieces of firebroken rock, for a total of 6881 cultural items. Six different components, as based on projectile point typologies, were identified for the Central Area as a result of the 1987 excavations: McKean (including Hanna), Pelican Lake, Sandy Creek, Besant, Avonlea, and Old Women's (comprised of Prairie Side Notched and Plains Side Notched).

The work described within this report constitutes final mitigation of impact to the Central Area of the Cranford Site, DlPb-2, by and for aggregate extraction activities. No further work pursuant to the use of this area for aggregate extraction is recommended. However, it is recommended that the fenced-off portion of the Western Area of the site remain fenced so as to preserve this area for future research.

Project Personnel

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LEGEND

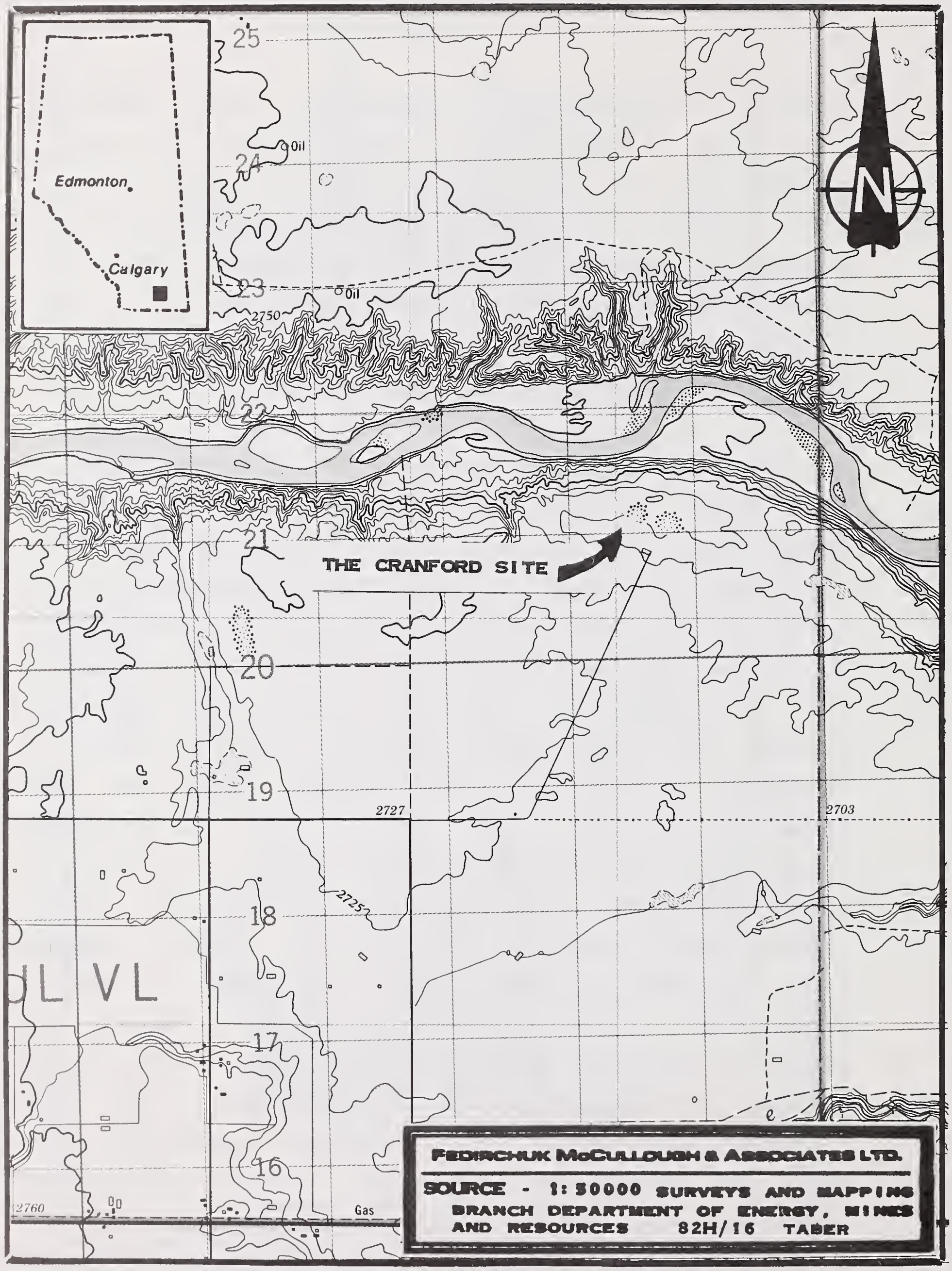
h	HAMMERSTONE	f	FLAKE
X	CHOPPER	b	BONE
✖	FLAKED COBBLE	u	UTILIZED FLAKE
t	TOOTH	×	SPLIT PEBBLE/COBBLE
ö	OCHRE	p	POINT
?	UNKNOWN OBJECT OF POSSIBLE CULTURAL SIGNIFICANCE	B	BIFACE
w	WEDGE/PIECE ESQUILLE	s	SCRAPER
v	CHERT FLAKES BELIEVED TO BE FROM SAME COBBLE	c	CORE
ṽ	UTILIZED (AS ABOVE)	R	RETOUCHED FLAKE
A	BROKEN ANVIL	●	UNIFACE

Legend for all floor plans.

1.0 INTRODUCTION

Alberta Transportation requested that Fedirchuk McCullough & Associates Ltd. conduct mitigative excavations in the Central Area of the Cranford Site, DlPb-2, so that aggregate extraction may proceed in that portion of the aggregate lease. The Cranford Site is a multi-component stone circle site located on the south bank of the Oldman River in south central Alberta (Figure 1).

The Cranford Site was found by Dr. Richard Forbis in 1959 while conducting a survey along the Oldman River for the Glenbow Alberta Foundation. He described the site as containing approximately 35 stone circles, as well as a few hearths and cairns. The site was re-inventoried during the winter of 1986 by ARESCO Ltd. so as to ascertain how much damage the site had received as a result of aggregate extraction; two gravel pits had been excavated in the site area. This re-inventory documented the presence of 80 rings, 5 cairns, a rock alignment, and several surface and buried lithic concentrations (ARESCO Ltd. 1986). ARESCO Ltd. returned in the summer of 1986 to conduct excavations at the site (Balcom 1987). Twenty nine stone circles were tested with a total of 256 square metres of excavation. In addition, the rock alignment was tested, and 120 shovel tests plus five 1m X 1m units were excavated. These excavations revealed that the site was more complex than had originally been thought, and further excavation of


Edmonton
Calgary
25
24
23
22
21
20
19
18
17
16
Oil
Oil
2750
2727
2703
2725
2760
Gas
L VL
N
THE CRANFORD SITE
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BRANCH DEPARTMENT OF ENERGY, MINES
AND RESOURCES 82H/16 TABER

Figure 1 Location of DlPb-2

the Central Area was recommended, as was the preservation of the West Area of the site.

The Central Area of the Cranford Site consists of 38 stone circles, all of which have now been excavated (Plate 1). (Note: an additional seven rings are located on a slightly lower terrace within the Central Area. However, these rings were not investigated within the scope of the present research and are excluded from all discussion.) As a result of the excavations conducted in 1987, six different components, as based on projectile point typologies, have been identified: McKean, (including Hanna), Pelican Lake, Sandy Creek, Besant, Avonlea, and Old Women's (comprised of Prairie Side Notched and Plains Side Notched). Excavation conducted at one of the McKean rings resulted in the discovery of what may be a pre-McKean buried component as well.

2.0 RESEARCH DESIGN

2.1 Problem Orientation

Within the context of the historical resource mitigation program, the goals of the study are to investigate cultural patterning within stone circles, to investigate temporal affiliations of the features within the site, and to identify factors contributing to or responsible for reoccupation of the site over a span of some 7000 years.

Plate 1 General view west of DlPb-2.

It has been suggested that the problems of cultural patterning might be best approached through isolation of idiosyncratic behaviour patterns (Carlisle and Gunn 1977; Gunn 1975). Specific categories of archaeological data, for example remains associated with tool production, can be analyzed in terms of individual behaviour from which cultural patterns can then be elicited. By expanding on this precept, it should also be possible to utilize systematically collected data from identical occupation units, ie. stone circles, to achieve the same goal. DlPb-2 is ideal for the pursuit of the latter avenue of research because it represents a unit which can be easily and justifiably partitioned into occupation units or subsets. The contents of the stone circles visible on the surface represent subsets as it may be assumed that each stone circle contains the remains of a single household, ie. a discrete facility, which is representative of the cultural pattern with which it is associated. Because there are numerous factors which determine the type and number of artifacts which will be preserved for recovery and analysis, it is reasonable to assume that a number of households will be required to identify any specific cultural pattern.

Based on the identification of Pelican Lake, Hanna, McKean, and Boss Hill projectile points in the west area of the site (Balcom 1987), a relationship of any of the stone circles, including the buried ones, to any of these cultural entities is plausible.

Within this context, the temporal and cultural identity of the individual stone circles as indicated by either time diagnostic artifacts or radiometric data is important to the resolution of the perceived cultural patterning within the buried remains and that expressed in the remains of the surficially visible stone circles.

According to Balcom (1987), her results do not suggest any good reason for site selection and reoccupation of the site. Given the continual occupation suggested by the projectile point styles, the site setting must have offered a significantly important set of attributes preferred by a hunting gathering society. An analysis of changing environmental conditions through time and resource availability as well as potential uses of the recovered cultural material may shed light on what factors enticed hunter gatherers to select this location over and over.

2.2 Specific Research Problems

The specific problems to be addressed by the project are: 1) vertical spatial relationships between the remains associated with the surficial stone circles and those associated with the buried stone circles, 2) temporal/cultural affiliation of the surficial and buried assemblages, 3) identification of discernible cultural patterning within the surficial stone circle complex and within the buried stone circles, 4) prehistoric environments in the site area, and 5) the place of DlPb-2 within the existing cultural-historical context of the northwestern plains.

2.3 Analytical Framework

Basic to archaeological interpretation is the identification of cultural patterning. For example, one facet of cultural patterning is expressed by artifact provenience and another facet is expressed by the formal range of variability of particular artifact types. The focus of the proposed analytical framework is the analysis of artifact provenience as it relates to discernible cultural patterning. In this context, acquisition of *in situ* data and temporal/cultural information are critical to the proposed research.

Because of the lack of precise *in situ* horizontal and vertical provenience data on the artifactual material obtained during the 1986 excavation program, maintenance of strict control on artifact provenience is critical to analysis of locational patterning. Precise *in situ* data will contribute to the separation of the surficial *versus* buried cultural assemblages, and will contribute to identification of discrete cultural patterns should they exist.

Implicit in the identification of patterning at DlPb-2 is contemporaneity in the temporal affiliation of the surficial stone circles. In order to test the hypothesis that the surficial stone circles represent a homogeneous Besant occupation, the apparent case as derived from Balcom's 1986 excavations, either time diagnostic artifacts or radiometric data are required. Recovery of radiometrically datable material and acquisition of absolute dates from each identified assemblage would also aid in clarifying the chronological/cultural relationship and the cultural integrity of the surficial and the buried stone circles. The results of these analyses would provide the basis for identifying cultural patterns within the assemblages and for comparison with sites of similar cultural affiliation in the northwestern plains.

Isolation of environmental variables responsible for site selection and reuse over time requires information additional to that which can be recovered from the excavations. Recovery of some data on the nature of past resource availability would form the basis for identifying some of the criteria used for the selection and reuse of DlPb-2 as a campsite location through time.

2.3.1 **Vertical Spatial Relationship**

To obtain the necessary *in situ* data for analysis, piece plotting the location of finished tools, debitage, bone, and firebroken rock was conducted. Vertically cohesive clusters of artifacts supplemented by provenience of features such as hearths and measurements of depth and weight of ring rocks are used to isolate the living floors. Homogeneity in horizontal patterning of, for example, particular tool types or firebroken rock distributions, forms the basis for formulation of locational patterning within stone circles.

2.3.2 Temporal/Cultural Affiliation of Assemblages

Recovery of time diagnostic material, ie. projectile points, from the surficial stone circles would resolve the question of whether or not this complex represents a homogeneous Besant occupation. Analysis of radiometrically datable material from several surficial stone circles as well as from buried stone circles will provide an accurate indication of the temporal relationship between these features. Because of the reported presence of bone, as opposed to charcoal, it was anticipated that radiometric dates from the surficial stone circles would be obtained on bone, providing that suitably sized items were obtained. Suitable bone recovered from buried components was also planned to be dated so as to acquire absolute dates for lower components. Although the finding of charcoal samples was not anticipated, these samples, if found, would also be dated where possible.

2.3.3 Identification of Cultural Patterning

Critical to identification of locational cultural patterning within the stone circles is the retrieval of a systematic 'subset' of archaeological materials from each of the stone circles to be impacted by proposed gravel extraction activities. This was achieved by excavation of a standard portion of each stone circle (subset) in order to obtain a standard set of information on the 'household'. Detailed analysis of the content of each of the stone circles, and comparison on an individual basis to attempt to identify similarities and differences was undertaken in an attempt to isolate potential patterns. Identification of cultural patterning was based on a combination of tool typology, frequency of occurrence of specific lithic types, stages of manufacturing process, horizontal distributions, and stone circle architecture. Comparison of the data from all of the surficial stone circles in the context of the assigned temporal/cultural affiliation was used to provide information as to the elements which reflect cultural patterning characteristic of any particular cultural entity. Using similar analysis, patterning would be identified within buried stone circles.

2.3.4 **Prehistoric Site Environments**

Pollen analysis of soil samples taken from the drainage channel discussed by Balcom (1987) are to be used to determine whether significant changes in vegetation cover, particularly the presence of wooded areas, had occurred. Similar analyses conducted on samples taken from the individual stone circles to obtain data suitable for determination of comparability in environments, and hence contemporaneity, between surficial features and location of buried surfaces associated with the buried components was also planned. Although pollen samples derived from soil are not as suitable for palaeoenvironmental reconstruction as pond sediment cores, it was hoped that significant data as to floral species present and relative proportions of these species could be obtained. Further, the regional vegetation consists of warm season (C_3) and cool season (C_4) grasses which reflect differences in the absorption (rate and amount) of the two stable isotopes of carbon (^{12}C and ^{13}C) during photosynthesis (McKinnon 1986). Because bison grazing on C_3 and C_4 plants retain the carbon isotope values in bone collagen, bone collagen composition provides data on the vegetation growing in the area at the time of site occupation. Both sets of data provide the requisite information on potential changes in environment in the general site area.

2.3.5 DlPb-2 in Northwestern Plains Prehistory

Discussion of the place of the site in northwestern plains prehistory focuses on comparing the Cranford Site to other Northwestern Plains tipi ring sites.

3.0 ENVIRONMENTAL SETTING

The Cranford Site lies within the Eastern Alberta Plains in the phytogeographic region which Moss (1955) designates the Mixed Prairie (Figure 2). The environmental setting for the research area has been thoroughly described by Balcom (1987:5-11) and only a summary of her work is required here.

The climate is characterized by warm summers with a mean May to September temperature of 15.0 °C, and cold winters with a mean December to February temperature of -10.5 °C, although variation around the mean is pronounced as a result of Chinook winds. Precipitation is light.

Glaciation of the area has been frequent, with the most recent glaciation terminating approximately 12000 to 15000 years ago. As the ice retreated, drainage channels began to incise themselves, and rivers attained their present configuration about 6000 to 8000 years ago.

The present topography consists of rolling hummocky moraine underlain by glacially deposited heterogeneous non-bedded rock deposits. Surficial deposits are composed of aeolian and alluvial sands and gravels. Chernozemic soils of limited depth overlay the gravel.

The site is located on the upper south terrace of the Oldman River. The river joins the Bow River

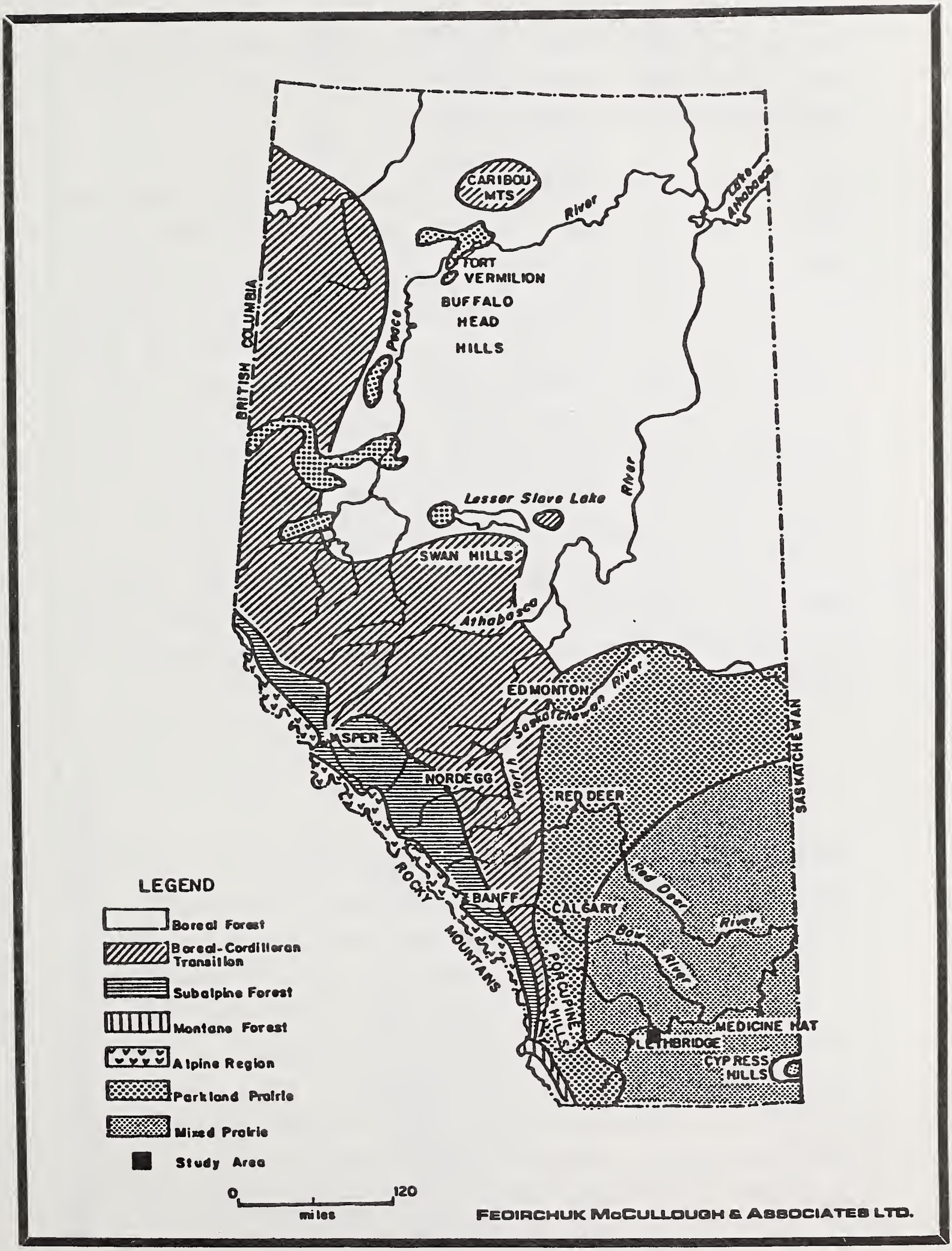

Figure 2 Physiographic Regions of Alberta

north of Grassy Lake, Alberta, where they combine to form the South Saskatchewan River which ultimately empties into the Hudson Bay.

The flora of the area is characterized by grama and spear grass, with minor amounts of clubmoss, sagewort, moss phlox and various sedges. Fauna of the area has changed markedly within the historic period; early explorers noted the presence of elk, moose, mountain sheep, bison, grizzly bear, wolf, and kit fox, none of which now occur in the area. Present inhabitants include pronghorn antelope, mule deer, white-tailed deer, coyote and bobcat; all these were likely present prehistorically. A variety of small mammals also inhabit the region. Numerous species of birds, ranging from song birds to game birds are also present, as are a variety of waterfowl.

4.0 STRATIGRAPHY

The stratigraphy of the central area of the Cranford Site is fairly simple, although the amount of sediment varied considerable from ring to ring. Profiles obtained from several rings are diagrammed in Figures 3 - 8. In general, the stratigraphy consists of an upper layer of humus with an average thickness of about 10 centimetres. This overlays a brown silt stratum containing various amounts of small pebbles. Beneath this stratum, and in several instances extending into the stratum, lies sterile

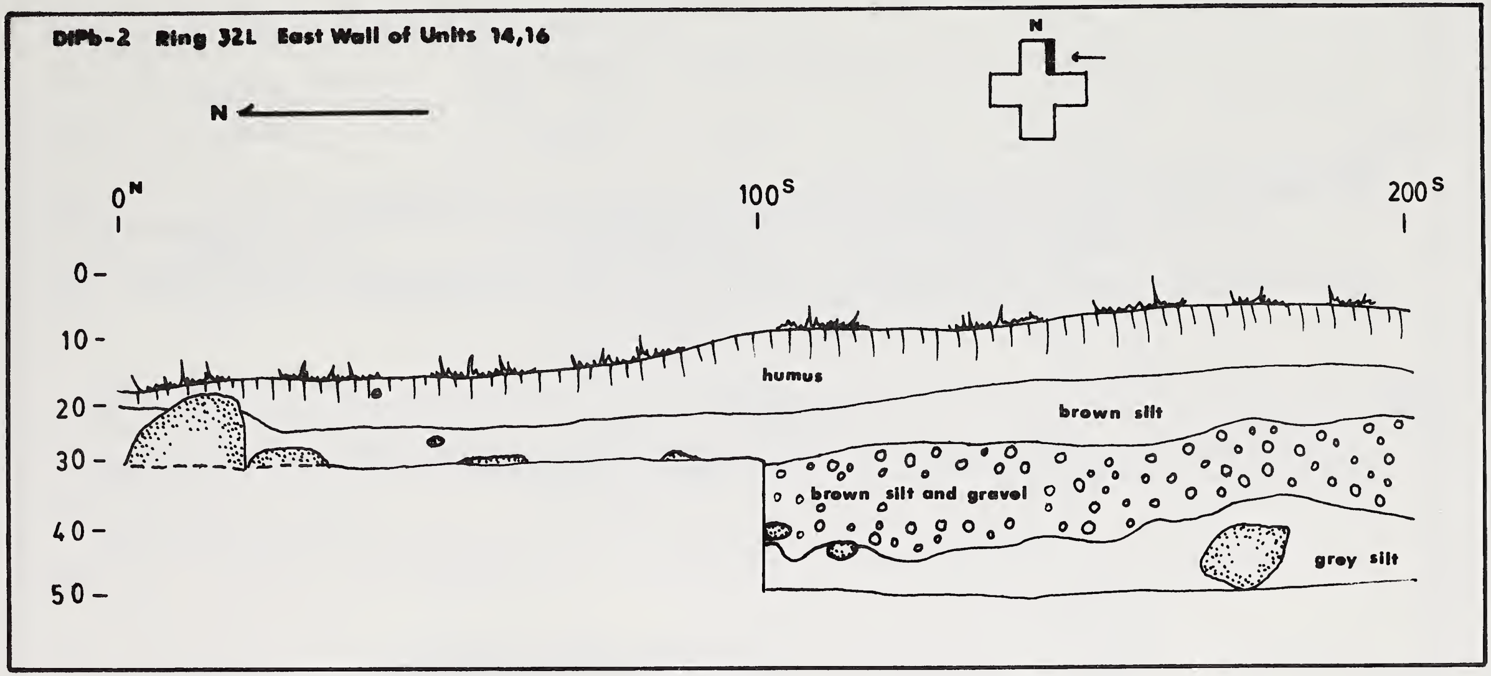

Figure 3 Soil Profile, Ring 321

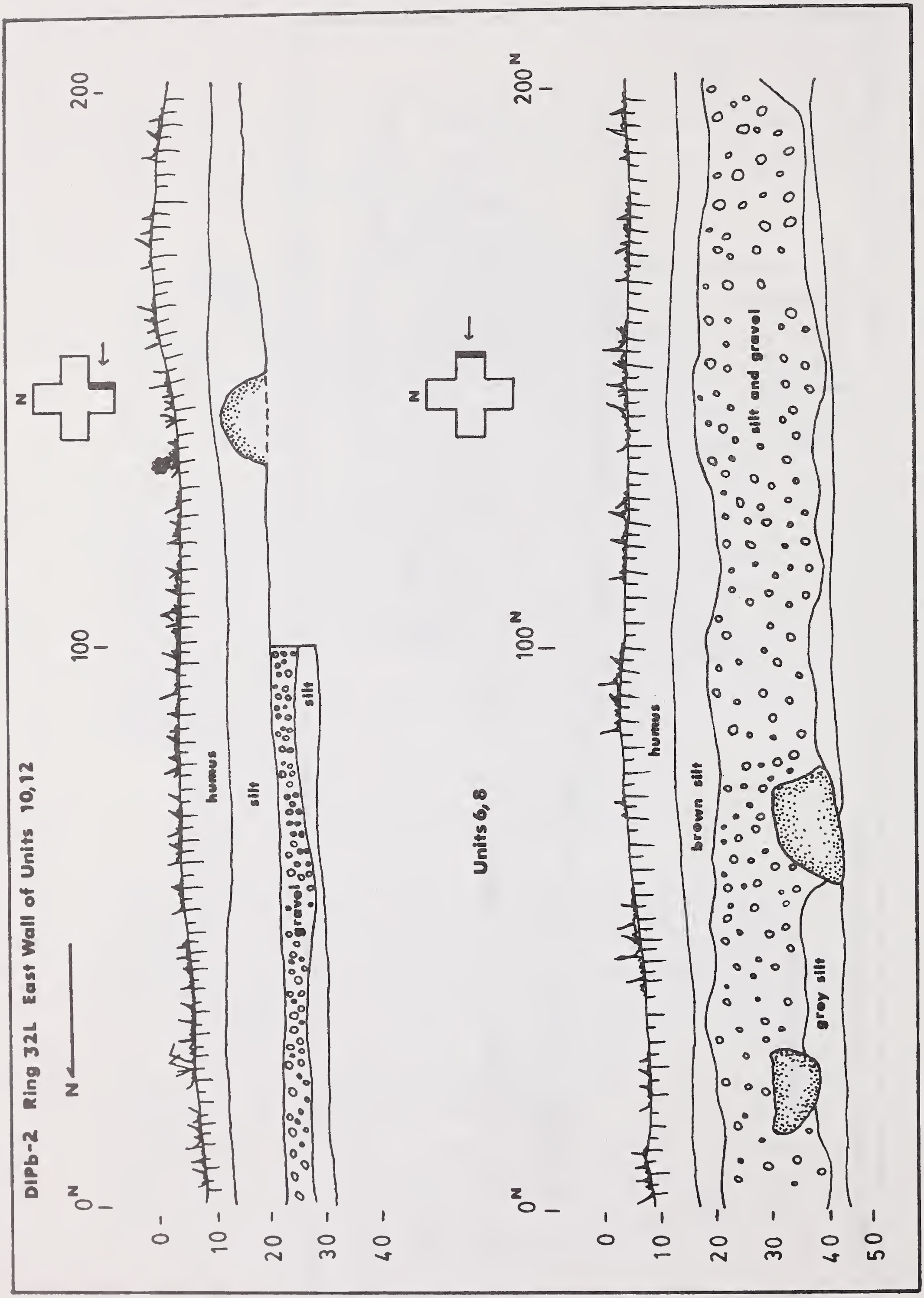

Figure 4 Soil Profiles Ring 321

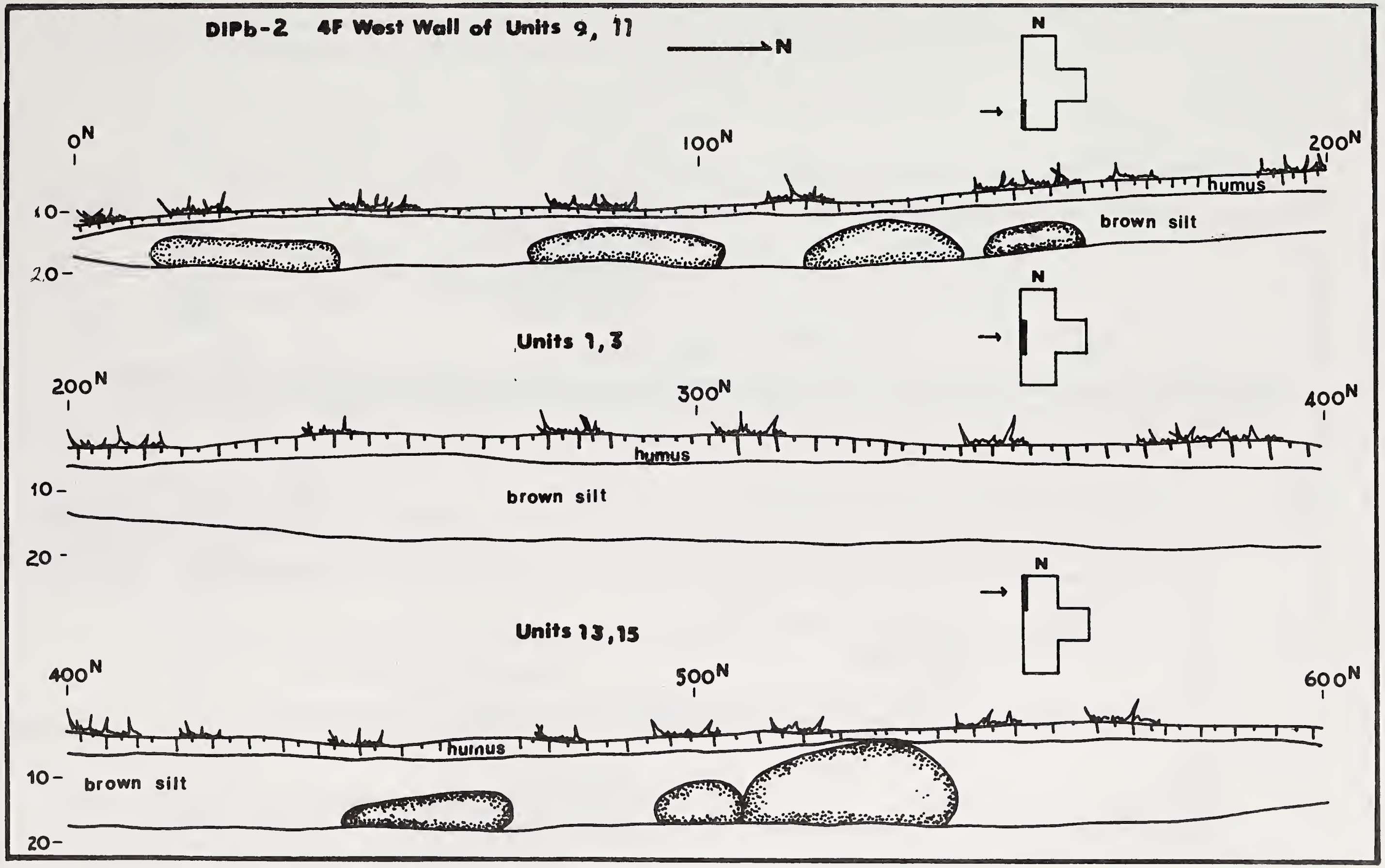

Figure 5 Soil Profiles, Ring 4f

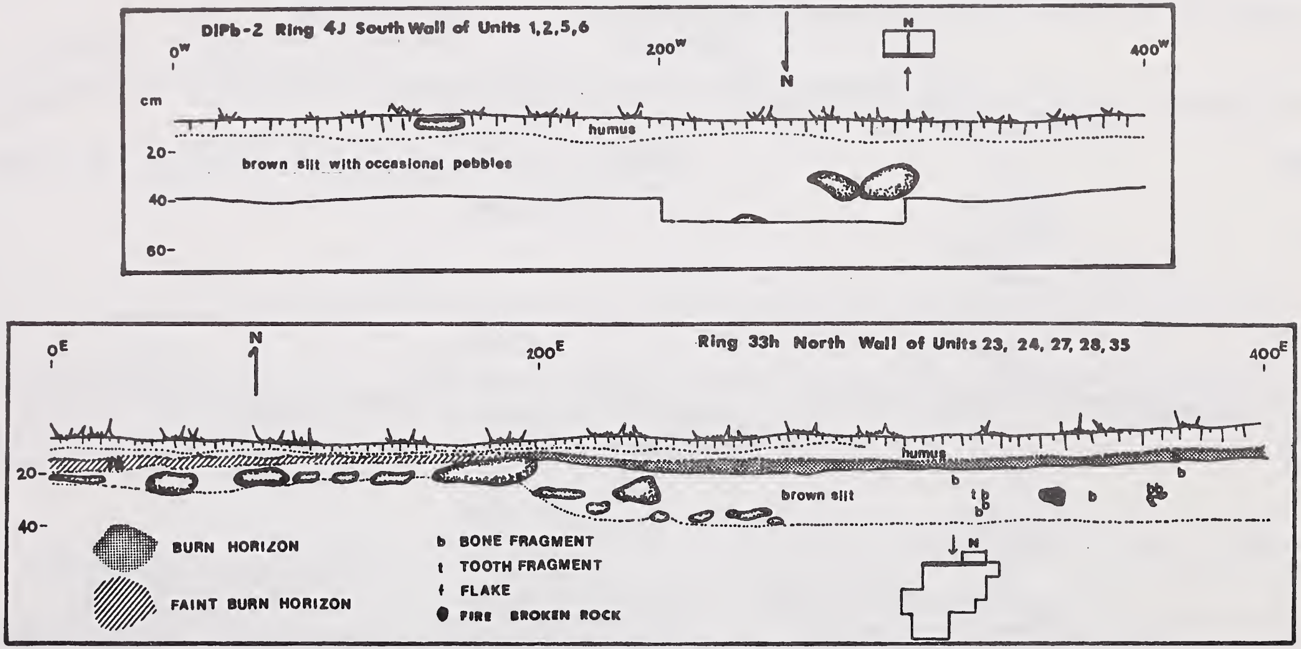

Figure 6 Soil Profiles, Ring 4j and 33h

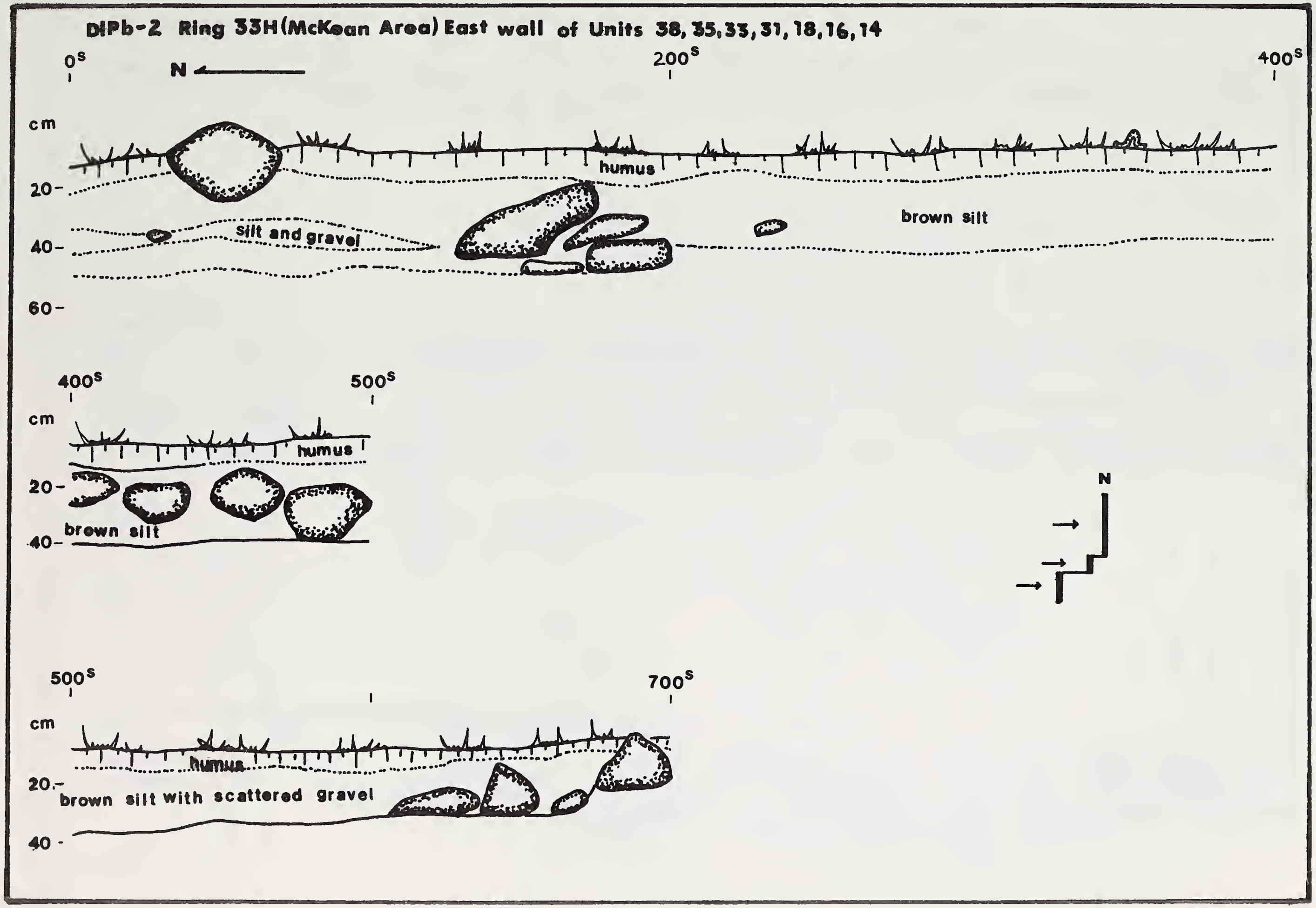
DlPb-2 Ring 33H(McKean Area) East wall of Units 38,35,33,31,18,16,14
0s
N
200s
400s
cm
20
40
60
humus
brown silt
silt and gravel
400s
500s
cm
20
40
humus
brown silt
N
500s
700s
cm
20
40
humus
brown silt with scattered gravel

Figure 7 Soil Profiles, Ring 33h

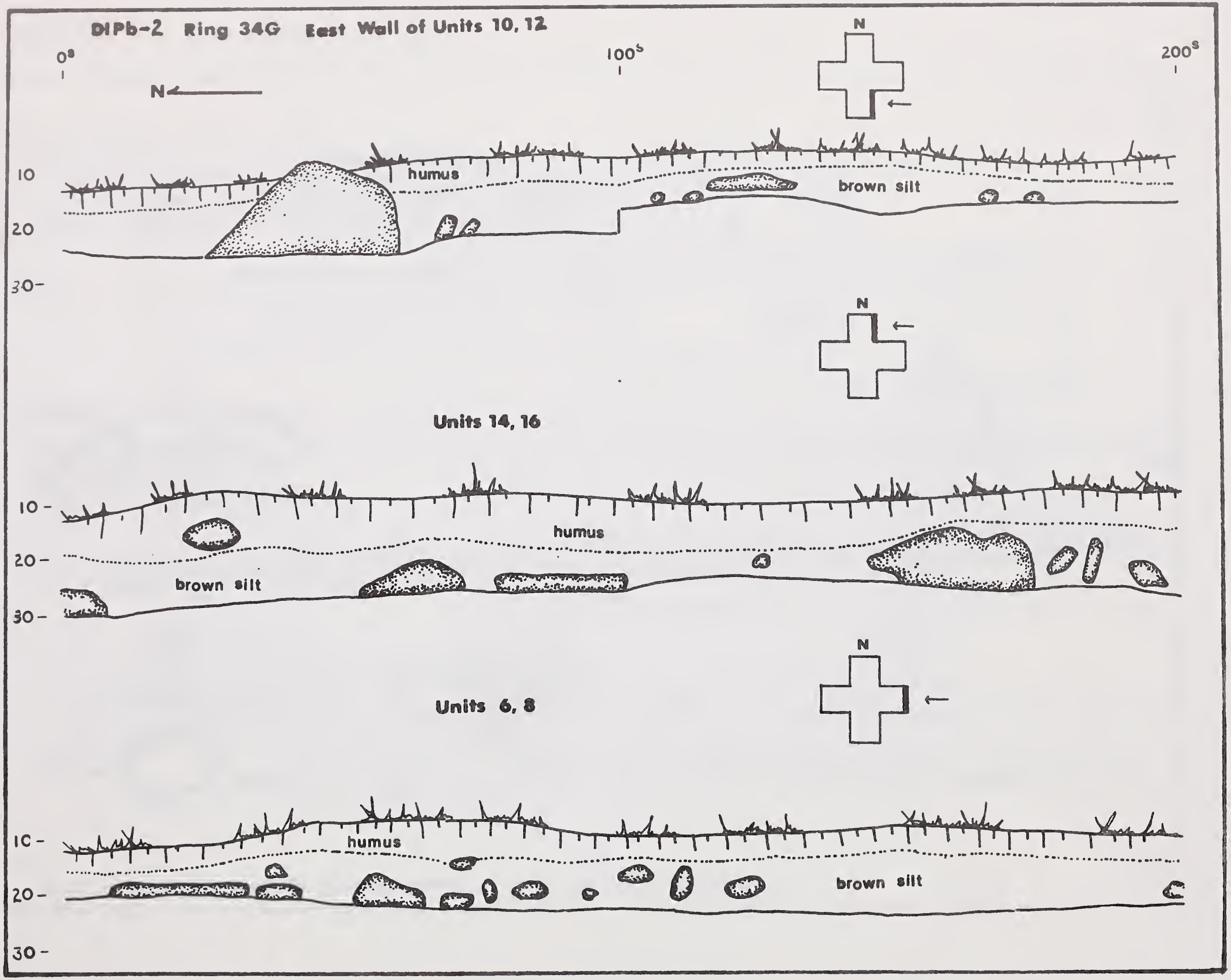

Figure 8 Soil Profiles, Ring 34g

cobbles. Ring 321 (Figures 3 & 4) displays a somewhat more complex stratigraphy. The upper component for this ring lies predominantly within the upper humus level. The Sandy Creek horizon is centred in the upper portion of the silt and gravel stratum. This stratum displays variable thickness and is discontinuous. The brown silt stratum tends to separate the two components, although cultural material was recovered from this stratum as well. Ring 321 also displayed a discontinuous grey silt stratum of variable thickness overlying the cobbles in some of the units. Some units were lacking both the silt and gravel stratum, and the grey silt stratum. Only at 321 was the grey silt stratum expressed. The significance of this is unknown.

Cultural material was generally recovered between 5 and 20 centimetres below surface, or from levels two through four. As can be seen from Figures 3 - 8, this primarily corresponds to the brown silt stratum.

5.0 METHODOLOGY

5.1 Mapping

Prior to excavation, all previously unmapped stone circles were mapped so as to illustrate the number and configuration of the ring rocks, as well as to identify surficial *versus* buried ring rocks. The twenty unmapped stone circles, as designated by

Balcom (1987) are: 3a, 3b, 3d, 4c, 4f, 4h, 4j, 4k, 6a, 32e, 32l, 33a, 33c, 33d, 34b, 34c, 34d, 34e, 34f, and 34g. Of these stone circles, 6a could not be relocated and was not mapped. In addition to these 19 stone circles, an additional 7 stone circles (33f, 33g, 33h, 33i, 33j, 34i, 34h) not recorded by Balcom were also mapped and subsequently excavated. The location and size of buried rocks, as well as a determination of the extent of burial for those rocks that were surficially visible, was obtained by using small probes (photo pins and ice picks). Interior and exterior diametres at eight points of the compass (true north, south, east, west, northeast, southeast, northwest, southwest) were measured to complete the data collection initiated by Balcom. Where possible, the ring rocks of all 38 stone circles to be impacted were weighed, and basal depths below surface were recorded. These latter data, in combination with provenience data, are particularly useful in determining the depth below surface of the tipi living floor. Given the multiple occupations present at the site, this type of information is critical for constructing the culture history of the site.

5.2 Excavation

A total of 220 square metres were excavated within the Central Area of the Cranford Site during the course of the 1987 excavation program. The first objective of the excavations was to obtain a standard set of data from each of the twenty stone circles which were not investigated by Balcom (1987) in 1986 but which will be impacted by aggregate extraction. In order to be consistent with the program undertaken by Balcom, each ring was excavated with a centrally located 2m X 2m unit. This program resulted in the excavation of 104 square metres at 26 stone circles.

So as to locate the unit in the exact centre of the stone circle, the centre of the circle had to be located first. This was done by obtaining four diametres, and averaging the results. Also, as all four diametres were measured simultaneously, the intersection of the tapes themselves gave a fairly accurate indication as to the centre of the circle. Once the centre was identified, this spot served as the centre of the 2m X 2m unit. The unit was oriented to true north - south by compass and appropriate declination corrects ($x = 20^{o}$).

In addition to these units, one 2m X 2m unit was allocated to each of the buried potential stone circles identified by Balcom (1987) in stone circles 4b and 4g. To obtain the necessary standard data subset, ie. the central portion of the stone circle, the arc of the exposed stone circles was to be used to approximate the centre of the buried tipi ring and to position the 2m X 2m unit. Unfortunately, Balcom's (1987) ring diagrams did not indicate the location of these buried ring rocks, nor were they able to be determined precisely by re-excavation of her units. Nevertheless, an attempt was made to test the centre of the buried ring below ring 4b by placing a unit to the west southwest of ring 4b (Figure 9). For ring 4g the additional 2m X 2m was placed immediately to the east of Balcom's unit.

Where the results obtained from the excavation of the initial 2m X 2m unit, from both the 1986 and 1987 programs, indicated that further excavation was warranted, all subsequently excavated units were located according to the same pattern of unit placement, except for Ring 33h. A 2m X 2m unit was located adjacent to, and immediately to the east of, the central unit, and if this unit was also productive, additional 2m X 2m units were excavated to the south, north, and west of the central 2m X 2m unit. This resulted in the excavation of a 't' or cross - shaped unit totalling 20 square metres in area, including the initial central 2m X 2m unit.

This excavation pattern was not followed for excavations conducted at Ring 33h. While excavating the central 2m X 2m unit within this stone circle, it became apparent that a buried McKean activity area underlaid the tipi ring. After consultation with the Archaeological Survey of Alberta, it was decided to allocate units so as to pursue this activity area, rather than to dogmatically adhere to the standard excavation plan. As a result, an irregular shaped block of units covering 32 square metres was excavated; this represents the single largest excavation block at the site. A summary of

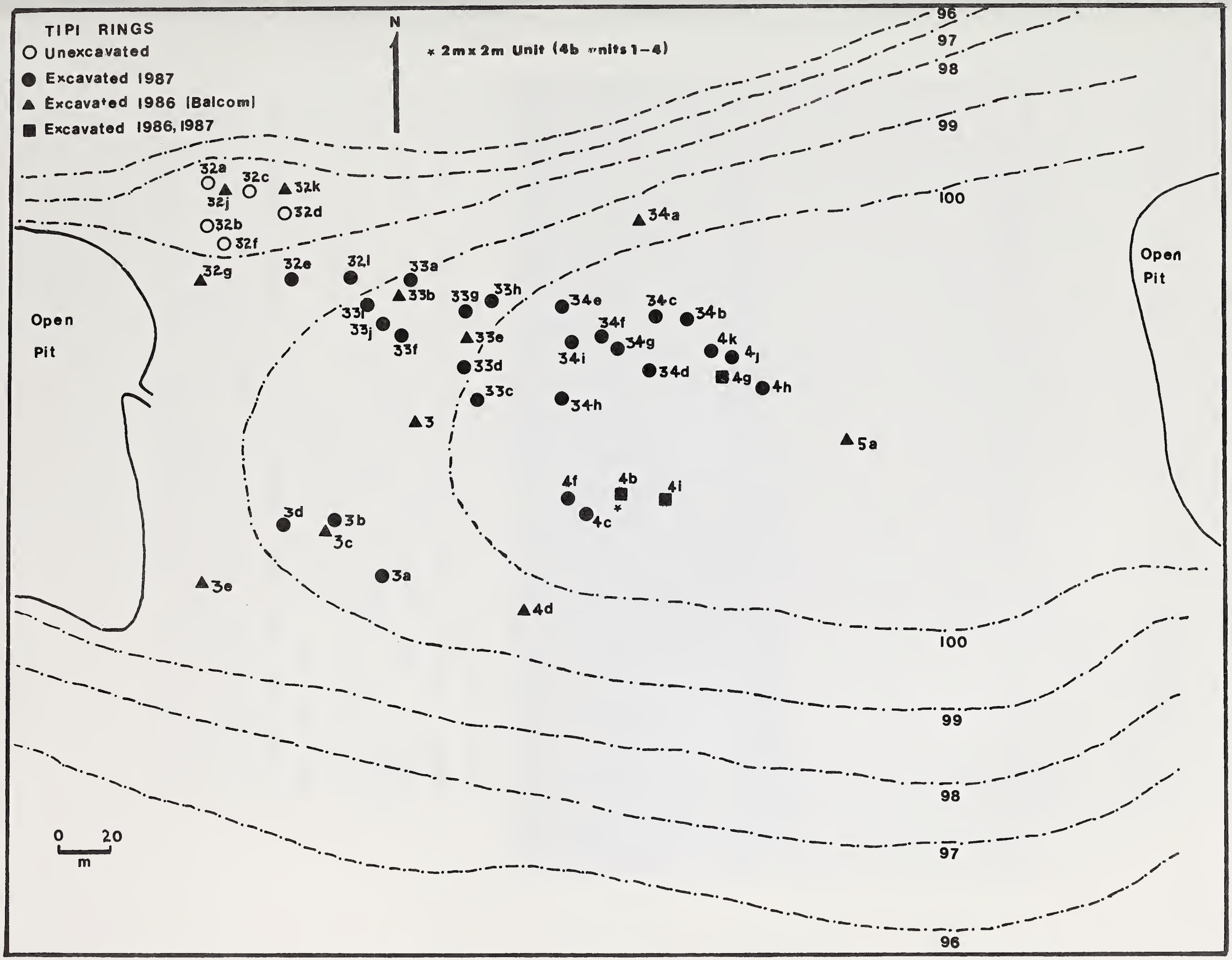

Figure 9 DlPb-2, Site Map

the allocation of all excavated units is provided below.

RING NO.	AREA EXCAVATED	RING NO.	AREA EXCAVATED
3a	4 sq m	3b	4 sq m
3d	4 sq m	4b	8 sq m
4c	4 sq m	4f	20 sq m
4g	16 sq m	4h	4 sq m
4i	4 sq m	4j	8 sq m
4k	4 sq m	32e	8 sq m
32l	20 sq m	33a	4 sq m
33c	4 sq m	33d	8 sq m
33f	4 sq m	33g	4 sq m
33h	32 sq m	33i	4 sq m
33j	4 sq m	34b	4 sq m
34c	4 sq m	34d	4 sq m
34e	4 sq m	34f	4 sq m
34g	20 sq m	34h	4 sq m
34i	4 sq m		

Table 1 Amount of Excavation per Ring

Excavation was conducted using standard troweling, shovel shaving, and backdirt screening methods (Plate 2), with two exceptions. First, where concentrations of very small (<5mm) flakes were noted, backdirt was screened using window screening (mesh = 2mm) so as to enhance artifact recovery. Second, an emphasis was placed on the *in situ* recording of the provenience of finished tools, debitage and faunal material. In addition, all firebroken rock was mapped *in situ* and weighed prior to discarding. As well, all rocks encountered prior to reaching the basal gravel were mapped. Vertical provenience for screening backdirt was maintained to

Plate 2 Screening in progress, DlPb-2

a maximum of five centimetres, and horizontal provenience was maintained to a maximum of one square metre. The combination of *in situ* recording and the excavation of 1m X 1m units in five centimetre levels allowed for the separation of cultural horizons more readily than the more standard procedure of excavating in 10 centimetre levels and placing little if any reliance on *in situ* recording of provenience.

4.3 Ancillary Techniques

Two ancillary techniques not commonly used in Alberta Plains archaeology are being attempted with the Cranford material -- stable carbon isotope analysis of bone samples recovered from the stone circles, and pollen analysis of soils recovered from on site and off site areas (see 2.0 Research Design).

Given the highly fragmentary nature of the bone recovered by Balcom (1987) in 1986, it was thought that traditional faunal analysis in terms of butchering analysis and subsistence strategies would be difficult if not impossible to conduct, and that some "non-traditional" form of analysis was therefore required. The faunal sample recovered from the 1987 excavations confirmed this initial thought. However, fragmentary bone samples are suitable for collagen extraction and subsequent stable carbon isotope analysis. The results of this analysis are presented in detail in Appendix A.

As only relatively small fragments of bone are required for this analysis, no special in field collection strategy, other than the careful notation of provenience, was undertaken. Samples for analysis were selected in the lab on the basis of cultural association so that some degree of temporal control could be established.

Although pollen preservation in Chernozem soils is poor, palynological analysis of the soil was still thought to be of value for a variety of reasons. First, it could provide data comparable to the stable carbon isotope analyses thereby allowing further refinement of the palaeoenvironmental record. Secondly, it could be used to test for the presence of a greater number of trees in the site area as hypothesized by Balcom (1987). Thirdly, variations between pollen types recovered from non-site and site areas may be of value in determining floral constituents of the diet. And fourthly, contemporaneity of occupation as indicated by homogeneity of pollen assemblage may be possible. Soil samples for pollen analysis were collected from within the rings, from a pit excavated into the relic drainage channel identified by Balcom, and from a large cut bank located south of the site. Samples are being processed at the University of Calgary.

6.0 RESULTS

During the course of the project, 2944 artifacts, comprised of 2943 lithics and 1 piece of pottery, 2772 faunal remains, and 1165 pieces of firebroken rock were recovered. A summary of this material by cultural phase and ring number is presented here. Detailed artifact descriptions and artifact plates are presented in Appendix B.

6.1 McKean Complex (circa 4500 - 3000 BP)

The McKean Complex constitutes the oldest securely documented occupation of the central area of the Cranford Site. Unfortunately, attempts to radiocarbon date the McKean occupation met with failure. Although two hearth matrix samples were sent to the Alberta Environment Centre, Environmental Isotopes Section for radiocarbon dating, neither sample could be dated due to contamination by fine roots.

A total of five features have been assigned to the this Complex. Ring 34g has been allocated to the Complex on the basis of the recovery of McKean lanceolate projectile points in clear association with the stone circle. Ring 33h has been tentatively assigned to the McKean Complex on the basis of the recovery of a Hanna point approximately 2 metres east of the ring from a depth suggesting contemporaneity with the ring. In addition to these two stone circles, three stone circles, 33d, 33g, and 34d, have also been assigned to the McKean Complex on the basis of recovering a lithic raw material type -- silicified volcanic ash -- diagnostic of the McKean occupation. In addition to these rings, a McKean Complex activity area was located beneath Ring 33h.

The total assemblage recovered from the McKean Complex stone circles (not including the activity area) consists of 1021 items: 576 lithic artifacts, 249 faunal remains -- none of which were identifiable as to species but are presumably dominated by bison with other minor constituents, such as antelope, present in small numbers -- and 196 pieces of firebroken rock. As will be discussed in greater detail in the ring summaries themselves, the figure of 1021 items does not represent all items recovered from the area circumscribed by the ring, but only those items whose provenience indicates contemporaneity with the ring.

Excavation of the McKean activity area resulted in the recovery of 614 lithic artifacts, 1502 faunal remains, and 292 pieces of firebroken rock for a total of 2408 cultural items. Classification of the lithic artifacts results in 6 projectile points, 1 biface, 1 pieces esquilles / wedge, 2 chopping tools, 4 scrapers, 9 retouched flakes, 10 utilized flakes, 5 cores or core fragments, 111 decortication flakes, 96 waste flakes, 218 secondary flakes, 124 thinning flakes, 1 resharpening flake, 22 retouch flakes, 1 core preparation flake, 2 hammerstones /

anvils, and 1 split pebble. Within the faunal assemblage 125 *Bison bison* mandible fragments, representing two different mandibles, 1 *Bison bison* proximal phalange, one *Bison bison* phalange, and a *Bison bison* left distal humerus fragment were recovered. This suggests an emphasis on bison hunting, but not necessarily to the point of exclusion of all other food animals. When combined with the stone circles, a total of 1190 lithic artifacts, 1751 faunal remains, and 488 pieces of firebroken rock, for a total of 3429 cultural items were recovered from the McKean occupation. This amounts to 49.8% of the total assemblage recovered during the 1987 excavation of the Cranford Site.

i) Ring 33h

Ring 33h has been tentatively ascribed to the McKean Complex on the basis of the recovery of a Hanna point from 13.5 centimetres below surface in unit 20, approximately 2 metres west of the ring (Figure 10). The ring is almost square in shape (Figure 10) with an average inside diametre of 3.52 metres, and outside diametre of 3.98 metres (Table 2). It was excavated with a total of approximately eight square metres. The figure is approximate as a result of pursuing the buried McKean activity area underneath the ring. Figure 15 shows the location of ring rocks in relation to excavation units.

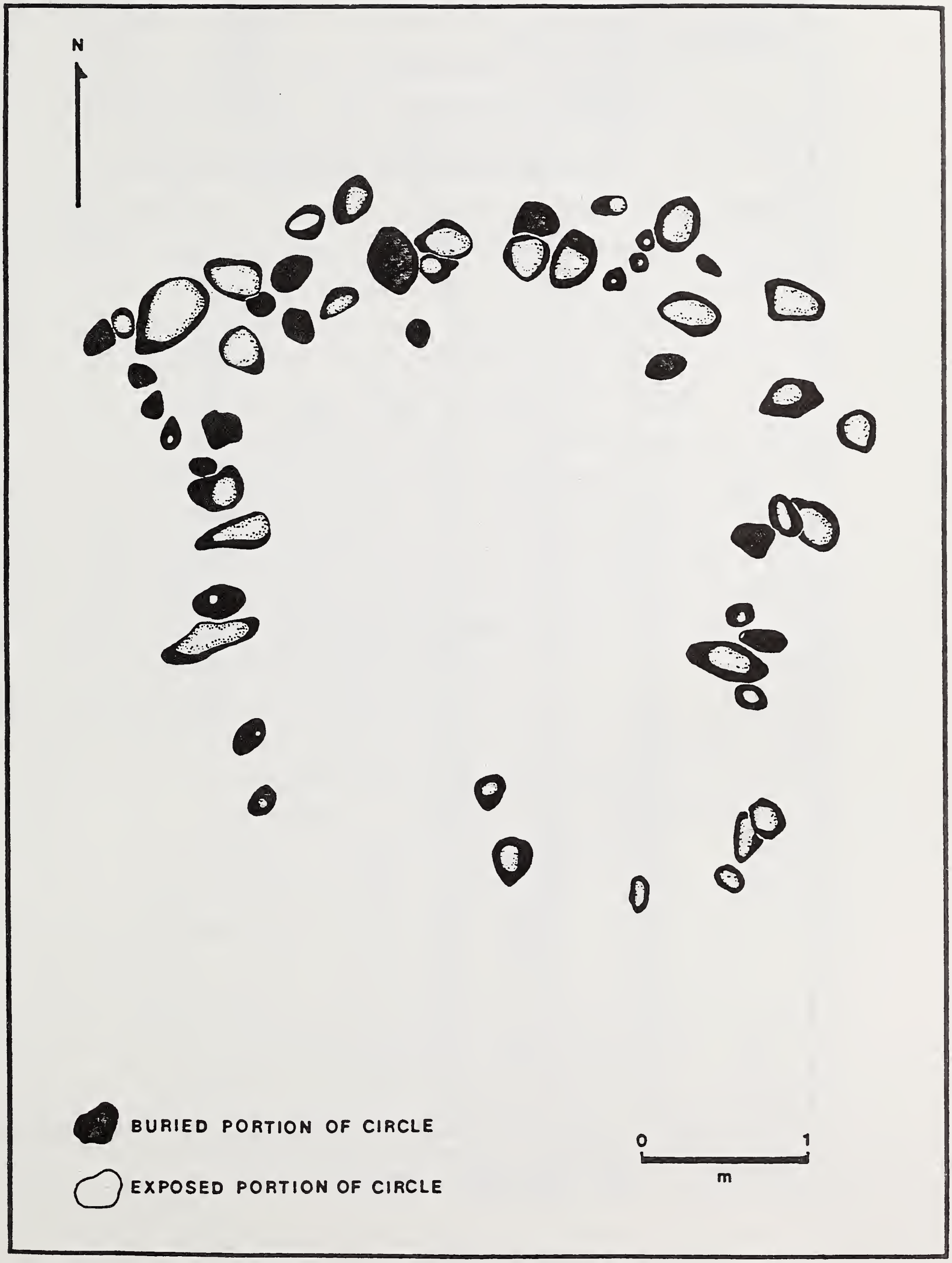

Figure 10 Feature Map, Ring 33h

RING 33h

		Inside	Outside	Average
Diametres:	North-South	3.68m	4.45m	4.06m
	Northeast - Southwest	3.68m	4.50m	4.09m
	East-West	3.40m	4.43m	3.92m
	Southeast-Northwest	3.30m	4.40m	3.85m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	7.5	10	W	35	14	13
	2	14	15		36	8.5	11
	3	9	10		37	7	9
	4	7	11		38	6.5	10
	5	2	7		39	4	8
	6	9	11		40	2	6
	7	7.5	9	NW	41	6	9
	8	8	9		42	3	8
	9	4.5	8		43	4	7
NE	10	11	14		44	5	10
	11	4	6		45	4	9
	12	4	7		46	16	14
	13	5	8		47	8	10
	14	6	7		48	10	11
	15	7	9		49	5	8
	16	11	10		50	6.5	8
	17	6	10		51	5	7
	18	8	11		52	7	9
E	19	6.5	8		53	6	11
	20	5	11				
	21	6.5	11				
	22	7	10				
	23	2	6				
	24	4	9				
	25	12	12				
SE	26	5	11				
	27	4.25	10				
	28	10.25	10				
	29	4.25	10				
	30	6	12				
S	31	5	8				
	32	7.5	11				
SW	33	4.5	9				
	34	7	10				

Table 2 Basic Ring Data, Ring 33h

The ring is composed of 53 stones (Table 2). As can be seen from Table 2 and Figure 10, the majority of the rocks are located toward the north, with 13 rocks with an average weight of 6.58 kilograms (combined weight of 85.5 kg) in the northwest, 9 with an average weight of 7.61 kilograms (combined weight of 68.50 kg) in the north, and 9 with an average weight of 6.00 kilograms (combined weight of 54.00 kg) in the northeast. The southern half of the ring contains far fewer rocks: 7 rocks with an average weight of 6.14 kilograms (combined weight of 43.00 kg) in the east, 5 rocks with an average weight of 5.95 kilograms (combined weight of 29.75 kg) in the southeast, only 2 rocks in the south with an average weight of 6.25 kilograms (combined weight of 12.50 kg), also 2 rocks in the southwest with an average weight of 5.75 kilograms (combined weight of 11.50 kg), and 6 rocks with an average weight of 7.00 kilograms (combined weight of 42.00 kg) in the west. Given the assumption that increased rock concentration reflects anticipated high velocity wind patterns (Brumley and Dau 1988), high wind gusts would have been generally from the north and particularly the north and northwest during the time of occupation. The shape of the ring indicates a greater likelihood of a northwest wind, as a wind from due north would strike a relatively broad aspect. However, it is likely that the present location of ring rocks reflects a slightly disturbed image of the original distribution as a result of removing the tipi, although it has been suggested that ring rocks may have been returned to their original location "so as to memorialize the stay and events at that location" (Davis 1983:256). In addition, the assumption of rock distribution as a direct correlate to wind direction may be erroneous (see McCullough and Hanna 1988). This subject is more fully addressed below.

The depths of the ring rocks range from a minimum of 6 (n=3) to a maximum of 15 (n=1) centimetres below surface, with a mean depth of 9.58 and modal depth of 10 centimetres below surface. When combined with artifact distributions for the ring (Table 3), this suggest that levels one (0 to 5 cms BS) to approximately the boundary between levels two (5 to 10 cms BS) and three (10 to 15 cms BS) are contemporaneous with the ring. Level three reflects a transitional level between the ring and the underlining McKean activity area, although the majority of the artifacts contained within this level are hypothesized to have come from the underlying McKean levels. The depth of the ring rocks, and the dramatic increase in artifacts recovered from level three *versus* level two supports this hypothesis. However, this does not necessarily mean that all artifacts contained within level

	LEVEL ONE				LEVEL TWO				LEVEL THREE				LEVEL FOUR				LEVEL FIVE				LEVEL SIX				LEVEL SEVEN				LEVEL EIGHT				ALL LEVELS			
	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM	AFC	FNL	FBR	COM
Ring 3a	1	0	1	2	0	0	0	0	3	4	0	7	6	0	3	9	3	0	2	5	X	X	X	X	X	X	X	X	X	X	X	X	13	4	6	23
Ring 3b	0	0	0	0	39	3	13	55	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	39	3	13	55
Ring 3d	0	1	1	2	19	2	2	23	5	2	22	29	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24	5	25	54
Ring 4b	2	0	0	2	13	3	0	16	25	7	1	33	22	71	11	104	11	1	5	17	11	2	4	17	2	4	0	6	0	1	0	1	86	89	21	196
Ring 4c	0	0	0	0	1	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1	0	0	1
Ring 4f	5	0	1	6	11	12	9	32	69	18	42	129	11	0	4	15	1	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X	97	30	56	183
Ring 4g	7	0	1	8	4	0	1	5	29	12	2	43	44	13	17	74	164	20	55	239	236	146	32	414	67	100	2	169	0	2	0	2	551	293	110	954
Ring 4h	0	0	0	0	9	1	18	28	8	12	8	28	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	17	13	26	56
Ring 4i	0	0	4	4	6	0	1	7	44	2	12	58	1	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	51	2	17	70
Ring 4j	0	0	0	0	20	6	0	26	5	7	+	12	16	14	1	31	13	30	+	43	6	21	+	27	2	2	0	4	0	3	0	3	62	83	1+	146
Ring 4k	0	0	0	0	4	0	0	4	3	0	0	3	4	10	0	14	4	3	0	7	X	X	X	X	X	X	X	X	X	X	X	X	15	13	0	28
Ring 32e	1	0	0	1	62	22	34	118	60	66	10	136	49	63	22	134	10	0	10	20	2	0	1	3	X	X	X	X	X	X	X	X	184	151	77	412
Ring 32i	2	0	0	2	199	16	11	226	37	31	17	85	25	71	2	98	22	75	34	131	9	36	22	67	5	37	37	79	X	X	X	X	299	266	123	688
Ring 33a	2	0	0	2	11	0	1	12	2	0	0	2	3	0	0	3	8	10	1	19	9	2	2	13	0	0	0	0	X	X	X	X	35	12	4	51
Ring 33c	0	0	0	0	4	0	22	26	5	0	2	7	1	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	10	0	24	34
Ring 33d	0	0	0	0	10	4	8	22	83	4	8	95	39	2	14	55	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	132	10	30	172
Ring 33f	1	0	0	1	5	3	0	8	15	7	12	34	21	0	1	22	15	0	1	16	X	X	X	X	X	X	X	X	X	X	X	X	57	10	14	81
Ring 33g	0	0	0	0	6	0	5	11	43	2	15	60	17	1	4	22	6	0	0	6	X	X	X	X	X	X	X	X	X	X	X	X	72	3	24	99
Ring 33h	4	1	0	5	48	7	48	103	145	133	74	352	210	588	96	894	201	515	89	805	59	230	27	316	0	36	6	42	X	X	X	X	667	1510	340	2517
Ring 33i	0	0	0	0	0	1	3	4	13	9	10	32	13	0	0	13	10	3	2	15	2	0	3	5	X	X	X	X	X	X	X	X	38	13	18	69
Ring 33j	0	0	0	0	9	3	12	24	5	0	2	7	7	1	1	9	14	15	0	29	6	0	2	8	0	0	15	15	X	X	X	X	41	19	32	92
Ring 34b	0	0	0	0	11	0	0	11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	11	0	0	11
Ring 34c	1	0	0	1	5	0	7	12	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	6	0	7	13
Ring 34d	2	0	2	4	17	0	10	27	10	0	4	14	13	0	2	15	0	0	2	2	X	X	X	X	X	X	X	X	X	X	X	X	42	0	20	62
Ring 34e	0	0	0	0	2	0	3	5	8	0	0	8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	10	0	3	13
Ring 34f	0	0	0	0	5	0	1	6	2	0	3	5	18	8	23	49	6	0	6	12	X	X	X	X	X	X	X	X	X	X	X	X	31	8	33	72
Ring 34g	7	0	5	12	79	0	12	91	182	0	41	223	31	0	30	61	1	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X	300	0	88	388
Ring 34h	0	0	0	0	8	2	10	20	7	3	31	41	2	2	1	5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	17	7	42	66
Ring 34i	0	0	0	0	8	0	8	16	10	0	3	13	18	0	0	18	0	0	0	0	X	X	X	X	X	X	X	X	X	X	X	X	36	0	11	47

AFC = Artifacts
FNL = Faunal
FBR = Fire Broken Rock
COM = Combined

Level One = 0 - 5 cm BS
Level Two = 5 - 10 cm BS
Level Three = 10 - 15 cm BS
Level Four = 15 - 20 cm BS
Level Five = 20 - 25 cm BS
Level Six = 25 - 30 cm BS
Level Seven = 30 - 35 cm BS
Level Eight = 35 - 40 cm BS

Table 3 Summary, Cultural Material Distribution

three can be ascribed to the activity area. But, as the majority of these artifacts are believed to be from the McKean activity area, all non-diagnostic artifacts recovered from level three will be grouped with the activity area in order to facilitate analysis; artifact density and provenience data suggest the McKean activity area is centred at 19 to 22 centimetres below surface.

The Hanna point recovered from level three presents a problem; is it associated with the ring or with the underlying McKean occupation? Brumley (1975), for example, recovered Hanna points in association with McKean lanceolate points at the Cactus Flower site, and Hanna points are generally perceived as belonging to the McKean Complex. The depth from which the point was recovered, 13.5 centimetres below surface, and its location outside of ring 33h do not aid in determining its' association. Nevertheless, I believe the point to be more likely associated with the ring than with the McKean occupation. This point represents the only Hanna point recovered from the central area of the site, whereas eight McKean lanceolate points were recovered, four from the activity area. The McKean occupation, as represented by McKean lanceolate points, is also the most fully documented culturally assigned occupation of the site (the majority of the rings excavated remain culturally unassigned). If the Hanna occupation was associated with the McKean occupation, I would expect to have found either a greater number of Hanna points, or a clearer association between the Hanna point and the underlying McKean activity area. As mentioned, the point was recovered from 13.5 centimetres below surface while the activity area is centred between 19 and 22 centimetres below surface. Therefore, as their does not appear to be a clear association between the Hanna point and the underlying activity area or an association between Hanna points and McKean points for the site in general, I believe the Hanna occupation to be discrete from the McKean occupation and that the point in question to be more likely associated with ring 33h than with the McKean activity area. The much smaller size of ring 33h in comparison to the rings ascribed to the McKean occupation supports this postulation.

All cultural material recovered from ring 33h is summarized in Table 3. The total cultural assemblage consists of 108 (3.38 items / sq m) items for ring 33h, 5 (0.16 items / sq m; 4.63%) from level one and 103 (3.21 items / sq m; 95.37%) from level two.

The distribution of artifacts by type *versus* raw material is summarized in Table 4. A total of 52 (1.62 items / sq m) artifacts were recovered from levels 1 and 2, the ring levels,

	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 33h: Levels 1 - 2			Ind.	Pebble	Etherington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces			1																			1
Chopping Tools																						
Scrapers (End/Side)										1												1
Retouched Flakes	1															1						2
Utilized Flakes	2																					2
Cores/Core Frags.																						
Decortication Flakes																						
Primary	5		1																			6
Secondary	7		1																			8
Waste Flakes																						
Shatter	2		3							1				1								7
Block Fracture																						
Secondary Flakes	9		6									2		1								18
Thinning			4													1						5
Resharpening									1													1
Retouch																						
Edge Preparation																						
Core Rejuvenation	1																					1
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	27		16						1	2		2		2		2						52

---

[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 4 Frequency of Artifacts Recovered by Material, Ring 33h

with the majority (n=48; 92.31%) coming from level two.

Lithic raw materials recovered from the ring levels include quartzite (n=27; 51.92%), chert (n=16; 30.84%), chalcedony (n=2; 3.85%), silicified siltstone (n=2; 3.85%), quartz (n=2, 3.85%), obsidian (n=2; 3.85%), and Knife River Flint (n=1; 1.92%). As is generally the case for Plains sites in Alberta, quartzite is the most common material, comprising over half of the assemblage.

A total of 8 (0.25 items / sq m) unidentifiable faunal remains were recovered from the ring levels, 1 (0.03 items / sq m; 12.50%) burnt bone fragment from level one and 3 bone fragments and 4 tooth fragments from level two (n=7; 0.22 items / sq m; 87.50%).

No firebroken rock was recovered from level one while 48 (1.5 items / sq m; 100.00%) pieces with a total weight of 3745 grams were recovered from level two.

ii) Ring 34g

Ring 34g has been ascribed to the McKean Complex on the basis of the recovery of 4 McKean lanceolate points. The ring is circular in outline (Figure 11) with an average inside diametre of 4.88 metres and outside diametre of

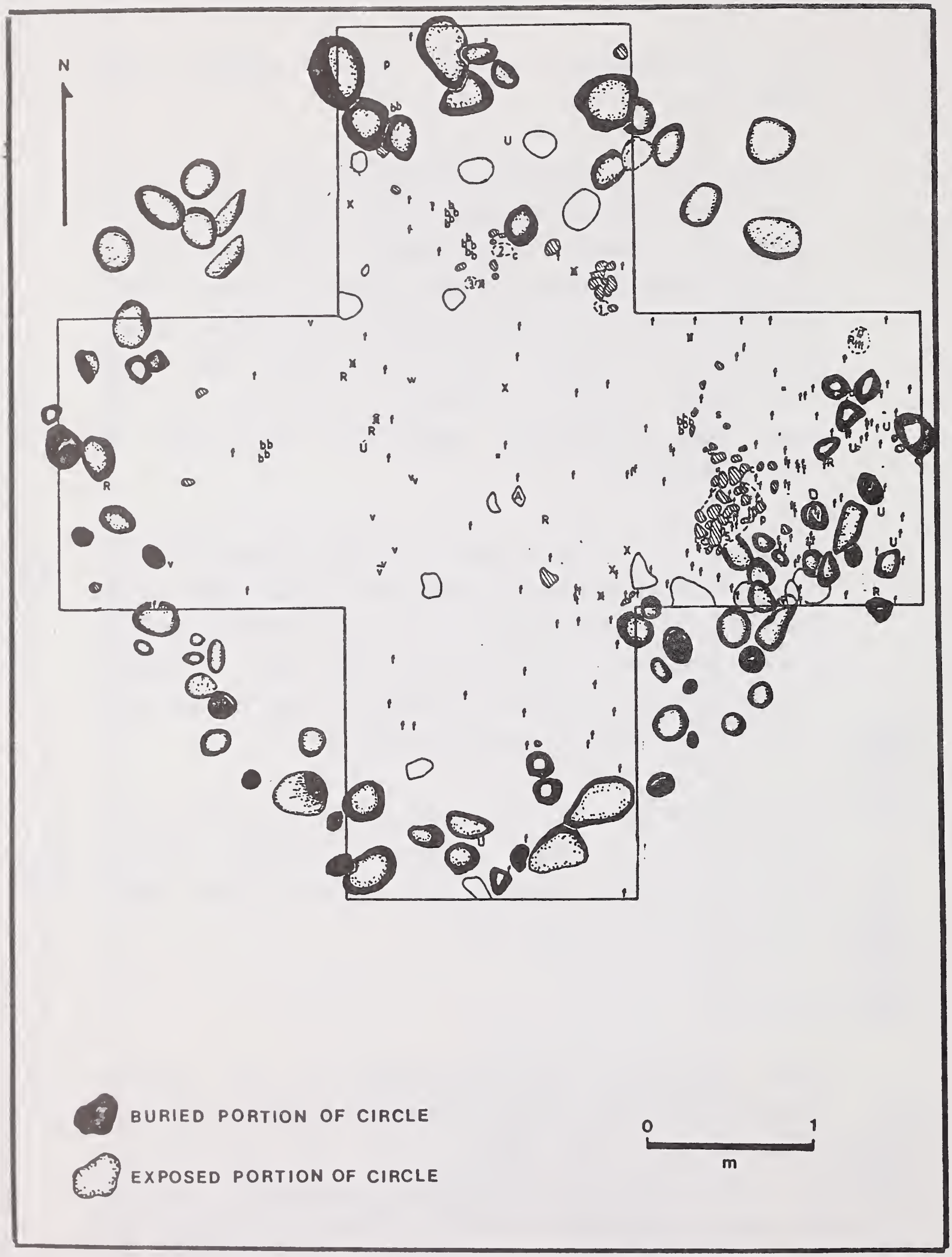

Figure 11 Feature Map, Ring 34g

RING 34g

Diametres:		Inside	Outside	Average
	North-South	4.95m	5.80m	5.38m
	Northeast - Southwest	4.90m	5.92m	5.41m
	East-West	4.85m	6.00m	5.42m
	Southeast-Northwest	4.80m	6.07m	5.44m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	21	14	SE	45	9	9
	2	8	10		46	2	6
	3	14.5	13		47	4	10
	4	20	14	S	48	3	10
	5	15	12		49	3.5	10
	6	8.5	12		50	12	8
	7	5.5	13		51	17	9
	8	22.5	13		52	4	9
	9	12.5	10		53	4	7
	10	10	11		54	4	12
	11	12.5	13		55	4	10
NE	12	9.5	10		56	6	9
	13	11	12		57	7	13
	14	10	12		58	4.5	9
	15	17	13		59	6	12
	16	23	13		60	3	12
E	17	5	8	SW	61	14	13
	18	7.5	9		62	7	11
	19	6.5	8		63	5	10
	20	10	10		64	5.5	10
	21	3	7		65	7	11
	22	5	5		66	7	9
	23	2	6		67	5	8
	24	11	5		68	4.5	9
	25	4	7		69	4	8
	26	5	10		70	2.5	8
	27	6	9		71	10	10
	28	6	9	W	72	3.5	10
	29	7	9		73	12	10
	30	5.5	10		74	4	9
	31	5	12		75	11	10
	32	8	9		76	6.5	10
	33	7.5	11		77	3	9
SE	34	9	12		78	3	8
	35	12	11		79	1.25	8
	36	10	9		80	5	8
	37	6	8		81	10	10
	38	7.5	10	NW	82	9	10
	39	5.5	9		83	8.5	10
	40	2	7		84	8	12
	41	8	8		85	10	13
	42	3	7		86	12	12
	43	11	9		87	9.5	11
	44	5	10				

Table 5 Basic Ring Data, Ring 34g

5.95 metres (Table 5). It was excavated with a total of 20 square metres.

The ring is composed of a total of 87 stones (Table 5). As can be seen from Figure 11 and Table 5, the rock distribution is more uniform than in ring 33h. The east contains the greatest number of rocks at 17 while the northeast and northwest contain the fewest rocks with 5 and 6 respectively. The north sector contains 11 rocks with an average weight of 13.64 kilograms (combined weight of 150.00 kgs). The northeast sectors' 5 rocks have an average weight of 14.10 kilograms (combined weight of 70.50 kgs). The east sectors' 17 rocks have an average weight of 6.12 kilograms (combined weight of 104.00 kgs). The southeast sector contains 14 rocks with an average weight of 6.71 kilograms (combined weight of 94.00 kgs). The south sector contains 13 rocks with an average weight of 5.77 kilograms (combined weight of 75.00 kgs). The southwest sector contains 11 rocks with an average weight of 6.50 kilograms (combined weight of 71.50 kgs). The west sector contains 10 rocks with an average weight of 5.925 kilograms (combined weight of 59.25 kgs). The northwest sector contains only 6 rocks with an average weight of 9.50 kilograms (combined weight of 57.00 kgs). In terms of weight the north sector contains the greatest quantity of rock while the northwest contains the least.

The depths of the ring rocks range from a minimum of 5 (n=2) to a maximum of 14 (n=2) centimetres below surface, with a mean depth of 9.89 and modal depth of 10 centimetres below surface. When combined with cultural material distributions for the ring, this suggests that levels 2 to 3 (5 to 15 cms BS) constitute the ring levels. The exact depth of the living floor varies across the ring due to variable deposition and slope but appears to be centred around 9 to 13 centimetres below surface. The low quantity of cultural material recovered from level one (N=12) may imply that these artifacts are contemporaneous with the ring but have been more greatly affected by bioturbation and congeliturbation.

The quantity of material recovered from level four (N=180) is more difficult to explain. Level four, at 15 to 20 centimetres below surface lies just below the most deeply buried ring rocks (14 cms BS). As the majority of the material recovered from level four consists of bone (n=119; 66.11%) with the remaining assemblage consisting of almost equal proportions of lithic artifacts and firebroken rock (n=31, 17.22%; and n=30, 16.67% respectively) it is possible that the distribution may reflect the excavation of shallow depressions for cooking and / or refuse disposal. Supporting this supposition is the fact that all level four bone was recovered between 17 and 19 centimetres below surface, occurs in well defined concentrations, and 59.66% (n=71) of the bone occurs in association with firebroken rock concentrations. In addition, 52.19% of all bone recovered from the ring, as well as 52.85% (by weight) of all firebroken rock was recovered from this level. As well, the feature labelled concentration five (Figure 11; Plate 3) does suggest a shallow pit feature. Brink et al. (1986), after conducting replicative experiments into stone boiling, suggest that hearths excavated into the ground retain heat better than do surface hearths. Therefore, if the firebroken rock contained within this concentration was heated outside of the ring (see below), then placing it within a shallow pit would help in retaining heat. The relatively few lithic artifacts recovered from this level is consistent with a slight downward movement of artifacts. A second possibility is that level four represents a second buried component, although I believe the data better supports the postulation of level four being contemporaneous with ring occupation.

All units were excavated to basal gravel, although the depth at which this gravel was reached was variable. Units 9 & 10 were excavated through two levels (0 to 10 cms BS), units 1 to 4, 7, 8, 11, 12, 18, and 20 were

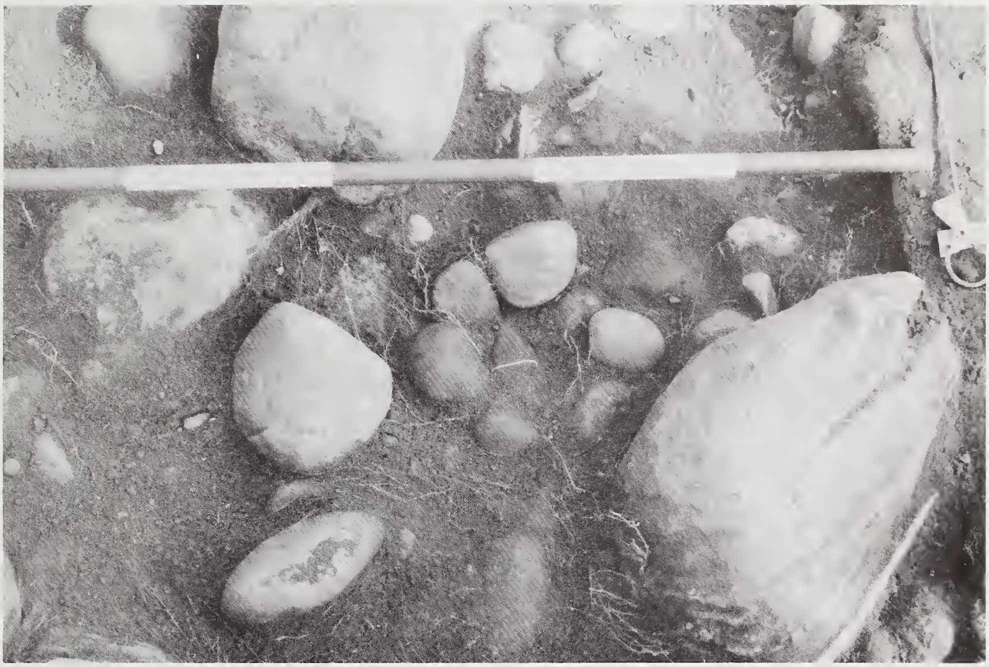

Plate 3 DlPb-2, Ring 34g, pit feature (Concentration 5).

excavated through three levels (0 to 15 cms BS), units 5, 6, 14 to 17, and 19 were excavated through four levels (0 to 20 cms BS), while unit 13 was excavated through five levels (0 to 25 cms BS). This variable depth to basal gravel provides indirect evidence for negating the hypothesis of a second buried component; such a component would be irregularly dispersed and intermixed with basal gravel. Although this is possible, the explanation provided above is more consistent with the available data.

In total, 616 (30.80 items / sq m) cultural items were recovered from ring 34g (Table 3). Of this total, 12 (0.60 items / sq m; 1.95%) came from level one, 92 (4.60 items / sq m; 14.94%) from level two, 331 (18.39 items / sq m; 53.73%) from level three, 180 (22.50 items / sq m; 29.22%) items from level four, and 1 (1.00 items / sq m; 0.16%) item from level five.

The distribution of lithic artifacts by type *versus* raw material is summarized in Table 6. A total of 300 (15.00 items / sq m) lithic artifacts were recovered from ring 34g, 79.67% (n=239; 11.95 items / sq m) of which were recovered *in situ*. The majority of the lithic artifacts (n=182; 9.1 items / sq m; 60.67%) came from level three. Level two contained 79 (3.95 items / sq m; 26.33%) lithics, level four

Ring 34g: All Levels	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]		3				1																4
Bifaces																						
Piece Esquilles/Wedges	1																					1
Unifaces																						
Chopping Tools	2											1					1					4
Scrapers (End/Side)																						
Retouched Flakes	4		2							1												7
Utilized Flakes	3	2	2	4				1			1					2	1					16
Cores/Core Frags.	2													1								3
Decortication Flakes																						
Primary	33		7														3					43
Secondary	39	1	9									1		1								51
Waste Flakes																						
Shatter	21		25						1								1					48
Block Fracture	6		5																			11
Secondary Flakes	19	5	17									1				1						43
Thinning	2	1	4							1	1											9
Resharpening	3															3						6
Retouch	14		15							1		1				4						35
Edge Preparation																						
Core Rejuvenation																						
Core Preparation	5		2																			7
Indeterminate																						
Hammerstones/Anvils	1																					1
Split Pebbles/Cobbles	4																					4
Gaming Piece												1										1
Potsherds																						
Flaked Cobble	4																					4
Grinding Stone																						
Indeterminate																					2	2
Total	163	12	88	4		1		1	1	3	2	5		2		10	6				2	300

---

[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

Table 6 Frequency of Artifacts Recovered by Material, Ring 34g

31 (1.55 items / sq m; 10.33%) lithic artifacts and level five 1 (0.05 items / sq m; 0.33%) artifact. Level one contained 7 (0.35 items / sq m; 2.33%) artifacts. Of the 4 projectile points recovered, 2 came from level two, 1 from level three and 1 from level four.

Lithic raw materials recovered from the ring include quartzite (n=163; 54.33%), chert (n=92; 30.67%), including 4 pebble chert artifacts, obsidian (n=10; 3.33%), argillite (n=6; 2.00%), silicified siltstone (n=5; 1.67%), chalcedony (n=3; 1.00%), brown chalcedony (n=2; 0.67%), quartz (n=2; 0.67%), ochre (n=2; 0.67%), a Swan River chert McKean lanceolate point (n=1; 0.33%), Avon chert (n=1; 0.33%), and Knife River Flint (n=1; 0.33%). Perhaps the most significant material present is a silicified volcanic ash. This material, although composing only 4.00% (n=12) of the assemblage appears to have been especially favoured for point manufacture; 3 of the 4 points recovered were made from this material. In addition, this material type was not recovered from any ring from which non-McKean diagnostic artifacts were recovered, suggesting the material is diagnostic of the McKean Complex occupation at this site.

The faunal assemblage consists of a total of 228 (11.4 items / sq m) small unidentifiable bone fragments. One (0.05 items / sq m; 0.44%)

fragment was recovered from level two, 108 (6.00 items / sq m; 47.36%) from level three, and 119 (14.88 items / sq m; 52.19%) from level four. The assemblage is too fragmentary to allow calculations of minimum numbers of individuals, or a discussion of butchering practices, other than to note that the bone appears to have been highly processed, although preservation problems associated with slow sedimentation rates may also be a factor in the highly fragmentary nature of the faunal assemblage.

A total of 88 (4.4 items / sq m) pieces of firebroken rock with a combined weight of 19819 grams were recovered from excavations at 34g. Five (0.25 items / sq m; 5.68%) pieces with a combined weight of 2461 grams (12.42%) were recovered from level one, 12 (0.60 items / sq m; 13.64%) pieces with a combined weight of 2024 grams (10.21%) in level two, 41 (2.28 items / sq m; 46.59%) pieces with a combined weight of 4859 grams (24.52%) in level three, and 30 (3.75 items / sq m; 34.09%) pieces with a combined weight of 10475 grams (52.85%) in level four.

As can be seen from Figure 11 the majority of this material is distributed toward the eastern and northern portions of the ring. In concentration five (Figure 11) the amount of firebroken rock and bone, including many tiny burnt fragments noted by the excavator but too fragmentary to collect, combined with staining of the soil, suggests this was the cooking area. As no charcoal was recovered from this concentration it is possible that the rock was heated outside of the tipi and then brought into the tipi for cooking. A secondary concentration of firebroken rock and bone (concentration 1, Figure 11) not displaying any soil staining may reflect a small refuse dump. The distribution of lithic artifacts suggests the eastern area of the ring served either as a refuse dump or flintknapping area. As the lithics are concentrated to the east of the firebroken rock concentration and the area to the west, or toward the interior of the ring contains relatively fewer artifacts, I suggest that the eastern extremity of the ring served as a refuse area for discarded flakes and tools. The number of artifacts located among the ring rocks suggests both post depositional movement of the artifacts, plus intentional discard of artifacts as close to the wall of the tipi as possible. The relative scarcity of cultural material to the west side of the tent reflects a lack of activity in this area, or conscientious cleaning of the area. Although there is no direct evidence for it, this lack of artifacts may reflect preferential use of the area for sleeping. The concentration of bone in the north, combined with the lack of stained earth, although a few pieces of firebroken rock were recovered, suggests this area was used more for eating of food than the preparation of food. The lack of any substantial amounts of firebroken rock or bone through the central and southern portions of the ring, combined with the random distribution of lithic artifacts suggests generalized activity areas. The concentration of retouched flakes, flaked cobbles, a utilized flake and wedge in unit three may represent a localized task specific activity area. The location of the door can not be established with certainty, although ethnographic analogues suggest that given the distribution of material within the ring, the east northeast would be a logical spot for a door.

iii) Ring 33d

Ring 33d has been ascribed to the McKean Complex on the basis of the recovery of artifacts made from silicified volcanic ash. The ring is roughly egg-shaped in outline (Figure 12) with an average inside diametre of 4.8 metres, and outside diametre of 5.5 metres (Table 7). It was excavated with a total of eight square metres, predominantly located within the ring.

The ring is composed of 45 stones (Table 7), although it is likely that two of these rocks, one in the north and one in the south -- rocks

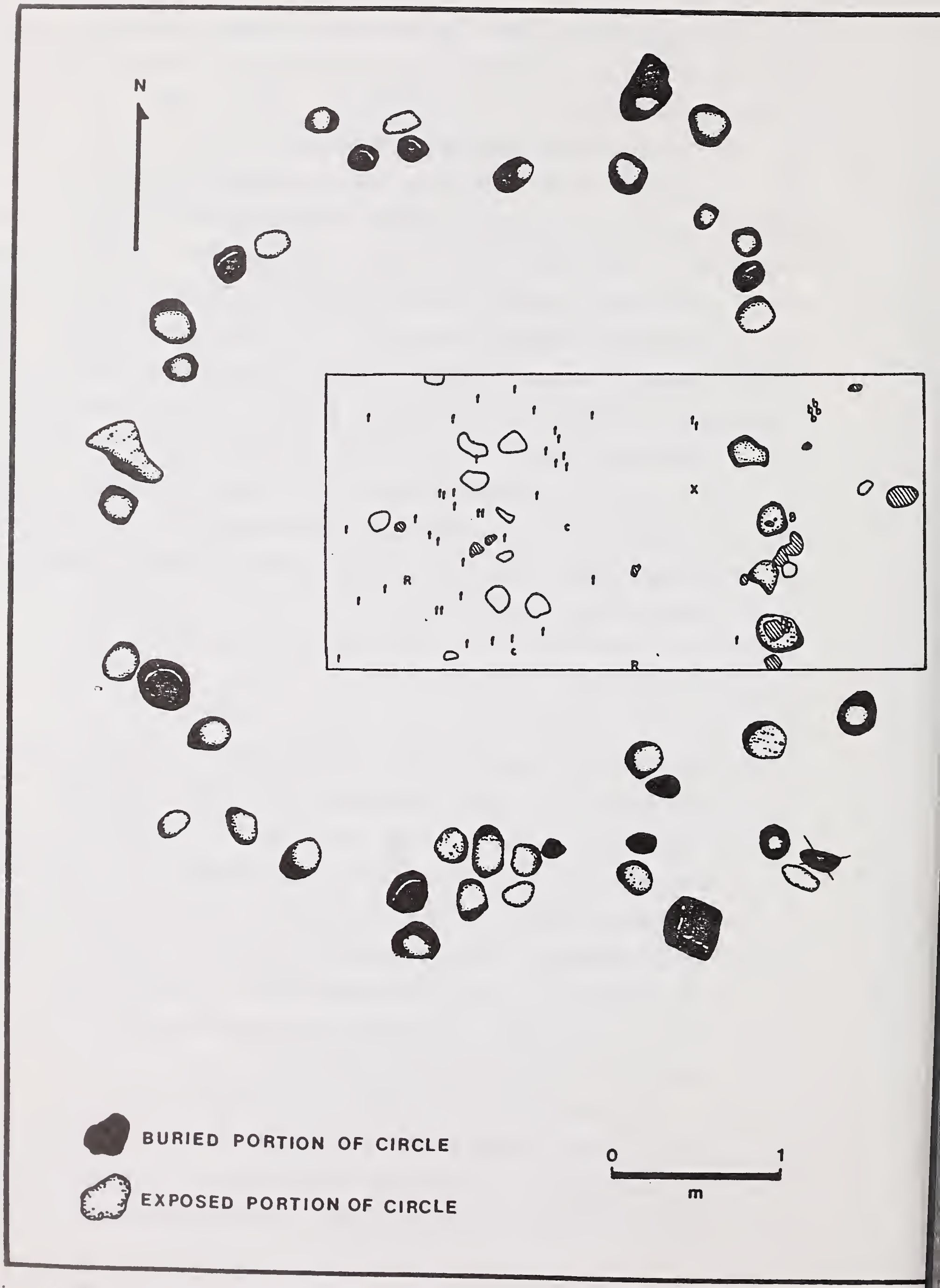

Figure 12 Feature Map, Ring 33d

RING 33d

		Inside	Outside	Average
Diametres:	North-South	5.20m	6.20m	5.70m
	Northeast - Southwest	4.20m	5.20m	4.70m
	East-West	4.70m	5.20m	4.95m
	Southeast-Northwest	5.10m	5.50m	5.30m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	5.5	13	SW	34	6	12
	2	4.5	11		35	2.5	7
	3	5.5	12		36	6.5	11
	4	7	13		37	8	10
	5	8.5	11		38	4	9
	6	21.5	24		39	10	11
NE	7	4.5	12	W	40	9.5	10
	8	10	14		41	17	16
	9	2.5	9	NW	42	6	11
	10	4	11		43	8	11
	11	5	13		44	4	9
	12	12.5	14		45	9.5	13
E	13	9	9				
	14	7	9.5				
	15	5	9.5				
	16	12	8.5				
SE	17	12.5	13				
	18	8	7				
	19	12	13				
	20	10	11				
	21	6	13				
	22	12.5	12				
	23	3	10				
	24	7	14				
	25	55.5	28				
S	26	6.5	16				
	27	11.5	16				
	28	4	12				
	29	10.5	15				
	30	12.5	16				
	31	6.5	16				
	32	20	14				
	33	9	15				

Table 7 Basic Ring Data, Ring 33d

6 and 25 -- are not ring rocks but naturally occurring gravel. In addition, one other rock mapped on Figure 12 was found to be too large to excavate and is also a naturally occurring cobble; it is marked by a superimposed X. The rocks display a roughly uniform distribution, although there is a slight concentration toward the south. The north sector contains 5 rocks with an average weight of 6.20 kilograms (combined weight of 31.00 kgs). The northeast sector contains 6 rocks with an average weight of 6.42 kilograms (combined weight of 38.50 kgs). The east sector contains 4 rocks with an average weight of 8.25 kilograms (combined weight of 33.00 kgs). The southeast and south sectors contain the greatest quantity of rock with 8 each. Rocks in the southeast sector average 8.88 kilograms in weight (combined weight of 71.00 kgs). The eight rocks in the south sector weigh an average of 10.06 kilograms each (combined weight of 80.50 kgs). The southwest sector contains 6 rocks with an average weight of 6.17 kilograms (combined weight of 37.00 kgs). The west sector contains the fewest rocks with 2 at an average weight of 13.25 kilograms (combined weight of 26.50 kgs). The northwest sector contains 4 rocks with an average weight of 6.88 kilograms (combined weight of 27.50 kgs). In terms of weight, the south and southeast contain the greatest quantity of rock.

The depths of the ring rocks range from a minimum of 7 (n=2) to a maximum of 16 (n=5) centimetres below surface, with a mean depth of 11.9 and modal depth of 11 centimetres below surface. When combined with cultural material distributions for the ring (Table 3), this suggests that levels two through four are contemporaneous with the ring. Although the ring was not completely excavated, available data suggests the living floor was located 12 to 13 centimetres below surface. All units were excavated to a depth of 20 centimetres below surface (four levels). No buried component is present.

All cultural material recovered during the course of excavating ring 33d is summarized in Table 3. A total of 172 (21.50 items / sq m) cultural items were recovered from levels two through four, no cultural material was recovered from level one. A total of 22 (2.75 items / sq m; 12.79%) items came from level two, 95 (11.88 items / sq m; 55.23%) from level three, and 55 (6.88 items / sq m; 31.98%) from level four.

The distribution of lithic artifacts by artifact type *versus* raw material is summarized in Table 8. A total of 132 (16.50 items / sq m) lithic artifacts were recovered from the ring, 10 (1.25 items / sq m; 7.58%) from level two, 83 (10.38 items / sq m; 62.88%) from level

	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Ring 33d: All Levels																						
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	1																					1
Scrapers (End/Side)																						
Retouched Flakes	1		3									1										6
Utilized Flakes			1																			1
Cores/Core Frags.	1													1								2
Decortication Flakes																						
Primary	5		1									1		1								8
Secondary	5		1																			6
Waste Flakes																						
Shatter	14		8									1	3	1		1						28
Block Fracture													1									1
Secondary Flakes	33	2	3								2	1		1		1						43
Thinning	16		6							2		7										31
Resharpening																						
Retouch	3		1																			4
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles														1								1
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	79	2	24							2	2	11	4	5		3						132

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 8 Frequency of Artifacts Recovered by Material, Ring 33d

three, and 39 (4.88 items / sq m; 29.54%) from level four.

Lithic raw materials recovered include quartzite (n=79; 59.85%), chert (n=24; 18.18%), silicified siltstone (n=11; 8.33%), quartz (n=5; 3.79%), petrified wood (n=4; 3.03%), obsidian (n=3; 2.27%), brown chalcedony (n=2; 1.51%), and chalcedony (n=2; 1.52%). Within the quartzite group, a green coloured quartzite makes up the majority. Given the quantity and type of artifacts recovered, predominantly flakes and shatter, it appears that a cobble of this quartzite was reduced within the ring. The occurrence of 2 (1.52%) pieces of silicified volcanic ash resulted in including this ring within the McKean Complex.

A total of 10 (1.25 items / sq m) unidentifiable faunal remains were recovered from ring 33d. Four (0.5 items / sq m; 40.00%) of these fragments came from each of levels 2 and 3, while 2 (0.25 items / sq m; 20.00%) items came from level four.

A total of 30 (3.75 items / sq m;) pieces of firebroken rock with a combined weight of 5343 grams were also recovered from the ring. Of these 30 items, 8 (1.00 items / sq m; 26.67%) with a combined weight of 1526 grams (28.50%) were recovered from level two, 8 (1.00 items / sq m; 26.67%) with a combined weight of 1482 grams (27.74%) from level three, and 14 (1.75 items / sq m; 46.67%) with a combined weight of 2335 grams (43.70%) from level four.

All cultural material recovered *in situ* is plotted on Figure 12. As only eight square metres were excavated, few comments concerning artifact distribution can be provided. The presence of the bone and the larger pieces of firebroken rock toward the east suggest intentional discard, possibly outside of the ring as little material occurs inside the eastern ring rocks but tends rather to be concentrated toward the centre of the ring.

iv) Ring 33g

Ring 33g has been ascribed to the McKean Complex on the basis of the recovery of an artifact made from silicified volcanic ash. The ring is very well defined and circular in outline (Figure 13) with an average inside diametre of 4.55 metres, and outside diametre of 5.85 metres (Table 9). The ring was excavated with a total of four square metres.

The ring is composed of 56 stones (Table 9) distributed in a roughly uniform fashion. The north and northeast sectors contain the greatest number of rocks at nine apiece, while the west contains the fewest at four. Proceeding clockwise from the north, the north

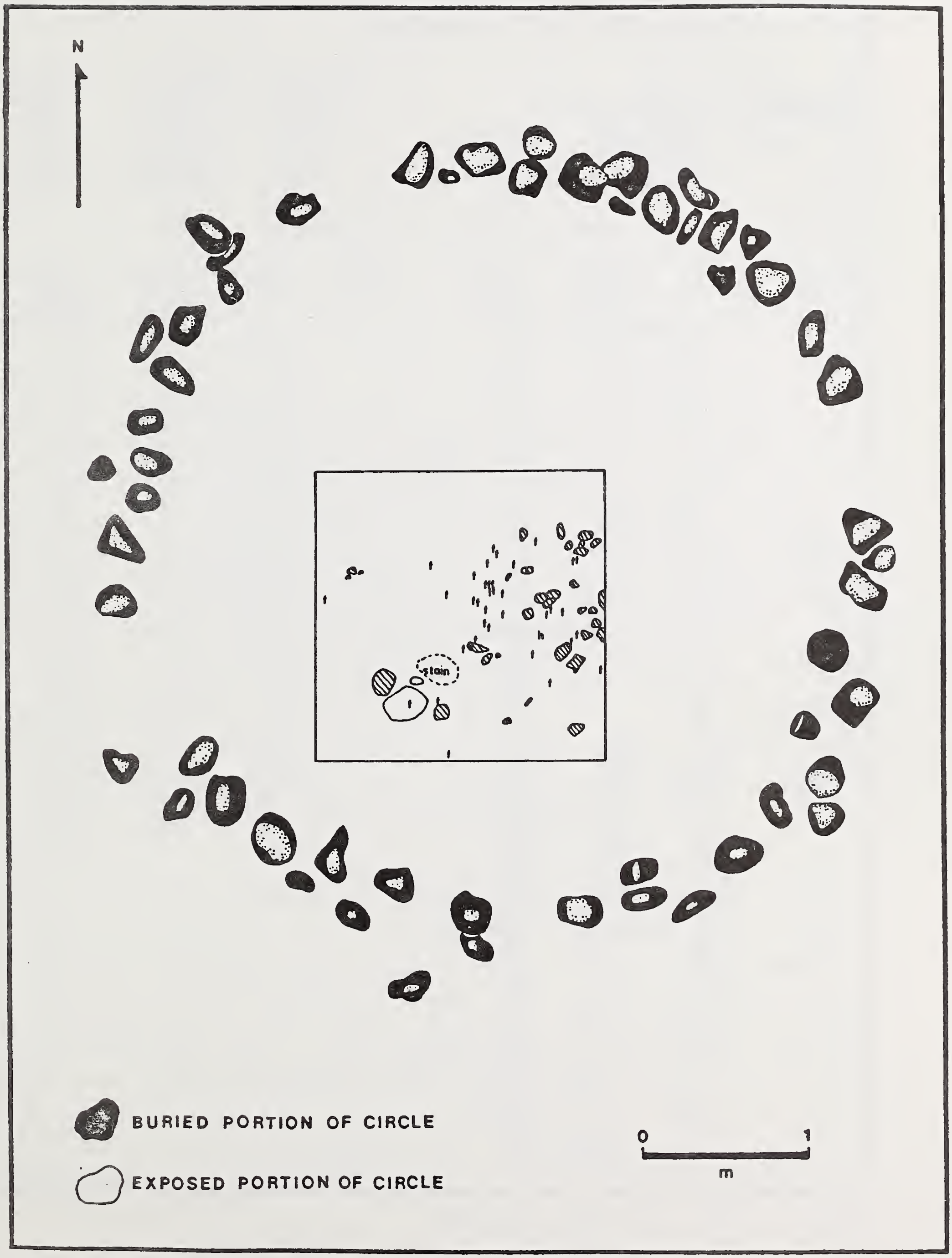

Figure 13 Feature Map, Ring 33g

RING 33g

		Inside	Outside	Average
Diametres:	North-South	4.80m	6.00m	5.40m
	Northeast - Southwest	4.20m	6.00m	5.10m
	East-West	4.80m	5.60m	5.20m
	Southeast-Northwest	4.40m	5.80m	5.10m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)
N	1	7.5	14
	2	8	12
	3	2	9
	4	6.5	12
	5	8	15
	6	6	14
	7	5	11
	8	17	12
	9	4	13
NE	10	7	14
	11	5.5	12
	12	3.5	13
	13	8	14
	14	5	15
	15	5.5	15
	16	9	14
	17	7	14
	18	11	13
E	19	12	15
	20	6	14
	21	10	16
	22	8	15
	23	9	16
	24	4.5	13
	25	8	15
SE	26	7.5	16
	27	6	13
	28	8.5	15
	29	9.5	14
	30	8	15
	31	5.5	14
	32	5	13
S	33	8.5	15
	34	6.5	17
S	35	5	13
	36	5	15
	37	7	14
SW	38	3.5	16
	39	12	15
	40	10.5	15
	41	8	16
	42	9	14
	43	8	13
	44	7.5	12
W	45	9.5	14
	46	9	15
	47	5	12
	48	4	11
NW	49	7	13
	50	6	12
	51	9.5	14
	52	7	13
	53	11.5	13
	54	6.5	14
	55	9	13
	56	5	12

Table 9 Basic Ring Data, Ring 33g

sectors' 9 rocks have an average weight of 7.11 kilograms (combined weight of 64.00 kgs). The northeast sectors' 9 rocks have an average weight of 6.83 kilograms (combined weight of 61.50 kgs). The east sector contains 7 rocks with an average weight of 8.21 kilograms (combined weight of 57.50 kgs). The southeast sector contains 7 rocks with an average weight of 7.14 kilograms (combined weight of 50.00 kgs). The south sector contains the second fewest rocks at 5 with an average weight of 6.40 kilograms (combined weight of 32.00 kgs). The southwest sector contains 7 rocks with an average weight of 8.36 kilograms (combined weight of 58.50 kgs). The west sector contains the fewest rocks with four at an average weight of 6.88 kilograms (combined weight of 27.50 kgs). The northwest sector contains 8 rocks with an average weight of 7.69 kilograms (combined weight of 61.50 kgs). Given this distribution of weight, the most heavily weighted sector is the north.

The depths of the ring rocks range from a minimum of 9 (n=1) to a maximum of 17 (n=1) centimetres below surface, with a mean depth of 13.77 and modal depth of 14 centimetres below surface. When combined with cultural material distributions for the ring (Table 3), this suggests that levels 3 and 4 are contemporaneous with ring occupation, with the heaviest concentration of material between 12 and 16 centimetres below surface. The small amount of material recovered from levels 2 and 5 suggest that these levels probably reflect vertical transportation of material out of levels 3 and 4. All units were excavated to a depth of 25 centimetres below surface (five levels). No buried or surface components are present.

A summary of all material recovered from 33g is presented in Table 3. A total of 99 (24.75 items / sq m) cultural items were recovered during the course of the excavation. Of this total 10 (2.5 items / sq m; 10.10%) items came from level two, 61 (15.25 items / sq m; 61.62%) from level three, 22 (5.50 items / sq m; 22.22%) from level four, and 6 (1.5 items / sq m; 6.06%) from level five.

The distribution of lithic artifacts by artifact type *versus* raw material is summarized in Table 10. A total of 72 (18.00 items / sq m) lithic artifacts were recovered from the ring, 6 (1.50 items / sq m; 8.33%) from level two, 43 (10.75 items / sq m; 59.72%) from level three, 17 (4.25 items / sq m; 23.61%) from level four, and 6 (1.50 items / sq m; 8.33%) from level five. No lithic artifacts were recovered from level one.

Lithic raw materials recovered include a high percentage of quartzite (n=57; 79.17%),

Ring 33g: All Levels

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes													1									1
Utilized Flakes																1						1
Cores/Core Frags.																						
Decortication Flakes																						
Primary	6		1											1								8
Secondary	7													1								8
Waste Flakes																						
Shatter	2													1								3
Block Fracture																						
Secondary Flakes	39		2											2								43
Thinning	2	1	3													1						7
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils	1																					1
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	57	1	6										1	5		2						72

---

[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT
CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ
GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 10 Frequency of Artifacts Recovered by Material, Ring 33g

followed by chert (n=6; 8.33%), quartz (n=5; 6.94%), obsidian (n=2; 2.78%), and petrified wood (n=1; 1.34%). The recovery of one (n=1; 1.34%) silicified volcanic ash thinning flake from level four allows placement of the ring within the McKean Complex.

The faunal assemblage is composed of only 3 (0.75 items / sq m) unidentifiable bone fragments. Two of these fragments (0.50 items / sq m; 66.67%) were recovered from level three, while the remaining item (n=1; 33.33%) was recovered from level four.

A total of 24 (6.00 items / sq m) pieces of firebroken rock with a combined weight of 7700 grams was recovered from ring 33g. Of this total, 4 (1.00 items / sq m; 16.67%) pieces with a combined weight of 3750 grams (48.70%) were derived from level two, 16 (4.00 items / sq m; 66.67%) with a combined weight of 3050 grams (39.61%) from level three, and 4 (1.00 items / sq m; 16.67%) with a combined weight of 900 grams (11.69%) from level four. Although the quantitative majority of firebroken rock came from level three, almost half, by weight, of the firebroken rock came from level two. This distribution is incongruous with the single component suggested by other data. One possible reason for this distribution derives from excavator error; a piece of firebroken rock encountered during excavation of level two may have been included within the level two assemblage even though the basal depth of the item indicates placement within level three. Recorded depths below surface indicate that this did happen in at least one case (in this one case, the item was transferred to level three and included within the level three material assemblage). Unfortunately basal depth was only recorded for two of the five pieces of firebroken rock derived from this level. Overall, the low artifact yield for this level, combined with the lack of any evidence for a level two occupation, such as a hearth stain, leads me to conclude that the material within this level is contemporaneous with occupation of the ring.

Unfortunately, this ring was not tested until very late during the excavation program. As a result, even though the ring contained a fairly high density of artifacts, no additional units were available to expand upon the test unit. Nevertheless, the distribution of material within the test unit indicates that the overall distribution may parallel that of ring 34g.

v) Ring 34d

Ring 34d has been ascribed to the McKean Complex on the basis of the recovery of an artifact made from silicified volcanic ash. The ring is roughly circular in outline

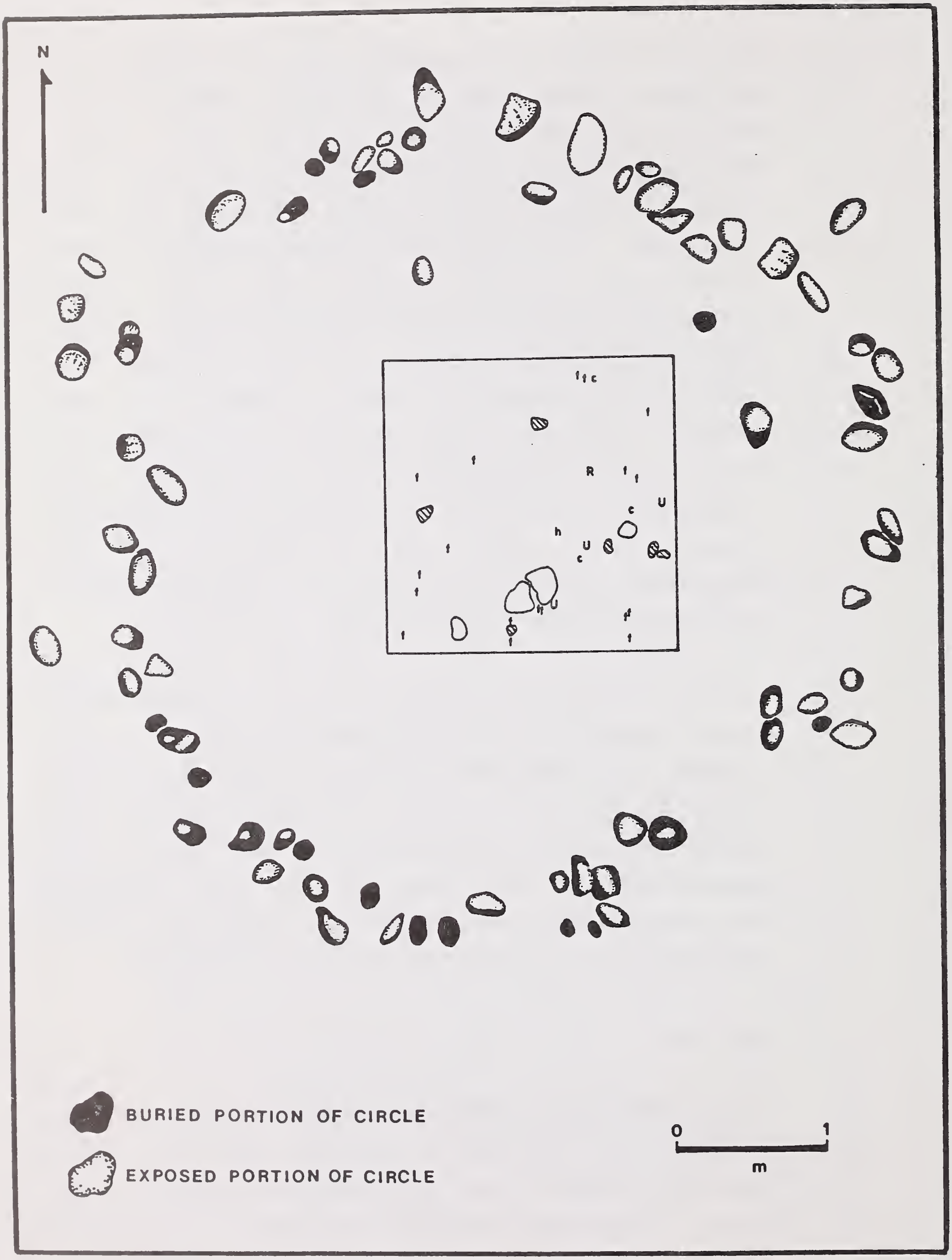

Figure 14 Feature Map, Ring 34d

RING 34d

		Inside	Outside	Average
Diametres:	North-South	4.95m	5.72m	5.34m
	Northeast - Southwest	4.64m	5.46m	5.05m
	East-West	4.55m	5.55m	5.05m
	Southeast-Northwest	4.43m	5.58m	5.00m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	3	9	S	38	11	14
	2	4	8		39	12	16
	3	4.5	9		40	7	14
	4	2	5		41	6	15
	5	2	7		42	8	17
	6	5	9		43	8	15
	7	4.5	10		44	4.5	14
	8	3.5	8		45	9	12
	9	14	15		46	14	16
	10	10	14		47	9	11
	11	7	13		48	5	11
	12	10.5	10		49	10	17
NE	13	5	12	SW	50	7	10
	14	4.5	12		51	7	13
	15	10	13		52	6.5	9
	16	9.5	14		53	7	12
	17	6	11		54	4	10
	18	8	11		55	8	14
	19	11	12		56	5.5	11
	20	5	10		57	7	15
	21	7	13		58	14	16
	22	6	11		59	6	10
E	23	5	8		60	6	7
	24	7	9		61	4.5	9
	25	18	20	W	62	8	10
	26	10	10		63	7.5	9
	27	14	11		64	12	13
	28	8	14		65	9	12
	29	10	15		66	10	14
	30	5	12		67	6	10
SE	31	3.5	9		68	8	13
	32	4.5	10		69	9	14
	33	5	14		70	6	14
	34	7	11		71	7.5	12
	35	4.5	11		72	7	13
	36	6	13		73	9	11
	37	16	17		74	9	14

Table 11 Basic Ring Data, Ring 34d

(Figure 14) with an average inside diametre of 4.64 metres and outside diametre of 5.58 metres (Table 11). The ring was excavated with a total of four square metres.

It is composed of 74 stones although one stone in the east sector -- rock 25 -- is probably not a ring rock (Table 11). The north, south and southwest sectors contain the greatest number of stones at 12 apiece, with the northwest containing the fewest at 5. The north sectors' 12 rocks have an average weight of 5.83 kilograms (combined weight of 70.00 kgs). The northeast sector contains 10 rocks with an average weight of 7.20 kilograms (combined weight of 72.00 kgs). The east sector contains 7 rocks (rock 25 has been omitted) with an average weight of 8.43 kilograms (combined weight of 59.00 kgs). The southeast sector also contains 7 rocks with an average weight of 6.64 kilograms (combined weight of 46.50 kgs). The south, which ties the north and southwest with 12 rocks, has an average weight of 8.62 kilograms per rock (combined weight of 103.50 kgs). The southwest sectors' 12 rocks have an average weight of 6.88 kilograms (combined weight of 82.50 kgs). The west sector contains 8 rocks with an average weight of 8.69 kilograms (combined weight of 69.50 kgs). The northwest sector contains the fewest rocks at 5 with an average weight of 7.70 kilograms (combined weight of

38.50 kgs). This distribution indicates that the greatest rock weights per sector are in the south and southwest.

The depths of the ring rocks range from a minimum of 5 (n=1) to a maximum of 17 (n=3) centimetres below surface, with an average depth of 11.88 and modal depth of 14 centimetres below surface. When combined with cultural material distributions for the ring, this suggests that levels 2 through 3/4 are all contemporaneous with the ring. In looking at lithic artifacts alone, there appears to be a concentration of artifacts from approximately 8 to 13 centimetres below surface (levels 2 and 3), and a second secondary concentration at 18 to 20 centimetres below surface (level four). Of the 10 artifacts recorded *in situ* for level four (N=13), 9 were recovered from 18 to 20 centimetres below surface. It is possible, therefore, that a second buried component underlying the McKean component is present; presumably the two pieces of firebroken rock recovered from level five would belong to this second component. On the other hand, as only 4 square metres were excavated within this ring, and only 2 of those were excavated through 4 levels, the artifact distribution may reflect sampling error rather than two components. Unfortunately, the possibility of a pre-McKean occupation was not noted in the field but through later analysis of provenience data. As a result, the determination of a possible pre-McKean occupation could not be documented through further excavation. Evidence for a pre-McKean occupation for the West end of the site was presented by Balcom (1987).

Combining all cultural material and all levels together, a total of 62 (15.50 items / sq m) items were recovered (Table 3). The ring levels yielded 46 (11.50 items / sq m; 74.19% of total assemblage) items while levels four and five yielded 16 (8.00 items / sq m; 25.81%) cultural items, not including the one artifact from level four that is believed to be contemporaneous with ring occupation. Within the ring levels, 4 (1.00 items / sq m; 8.70% of ring assemblage) cultural items came from level one, 27 (6.75 items / sq m; 58.70%) from level two, 14 (3.50 items / sq m; 30.43%) from level three, and 1 (0.50 items / sq m; 2.17%) from level four. The possible second component consists of 14 (7.00 items / sq m; 87.50% of component assemblage) items from level four and 2 (2.00 items / sq m; 12.50%) from level five.

The distribution of lithic artifacts by artifact type *versus* raw material for each of the two components is summarized in Tables 12 & 13. As it is uncertain whether or not the majority of artifacts recovered from level four are contemporaneous or not with the ring, the level four data, aside from a utilized chert

	QTZITE	S.A.	Ind.	Pebble	CHERT Ether-ington	Swan River	Montana	Avon	KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 34d: Levels 1 - 3																						
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes			1																			1
Utilized Flakes	1		1																			2
Cores/Core Frags.	1																					1
Decortication Flakes																						
Primary	2		2																			4
Secondary	4																					4
Waste Flakes			1									1										2
Shatter																						
Block Fracture																						
Secondary Flakes	7	1	3											1								12
Thinning			1									1										2
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation	1																					1
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	16	1	9									2		1								29

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

Table 12 Frequency of Artifacts Recovered by Material, Ring 34d, Component 1

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Ring 34d: Levels 4 - 5																						
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes			1																			1
Cores/Core Frags.	2																					2
Decortication Flakes																						
Primary	1																					1
Secondary	4																					4
Waste Flakes																						
Shatter																						
Block Fracture																						
Secondary Flakes	3													1								4
Thinning																						
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils	1																					1
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	11		1											1								13

---

[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 13 Frequency of Artifacts Recovered by Material, Ring 34d, Component 2

flake recovered from unit 2 100N 91E 16BS, and therefore believed to be contemporaneous with ring occupation, will not be included within the ring levels. As only 4 cultural items (2 lithics, 2 firebroken rock) were recovered from level one, and these were all recovered toward the base of the level, I believe them to be contemporaneous with ring occupation. Thus, a total of 30 lithic artifacts (7.50 items / sq m) were recovered from ring 34d. Of this total 2 (0.50 items / sq m; 6.67%) items came from level one, 17 (4.25 items / sq m; 56.67%) from level two, 10 (2.50 items / sq m; 33.33%) from level three, and 1 (0.50 items / sq m; 3.33%) from level four.

As no lithics came from level five, all lithic artifacts that may belong to the second component were derived from level four. This amounts to a total of 12 artifacts (6.00 items / sq m), three of which were recovered from the screen. As only 1 out of 10 artifacts found *in situ* could be correlated to the ring, I believe that grouping the three artifacts from the screen with the nine 'second component' artifacts rather than the one 'ring' artifact more likely reflects reality. Within this group, 11 (91.67%) artifacts are quartzite while the remaining artifact (n=1; 8.33%) was produced from quartz.

Lithic raw materials recovered from the ring levels include quartzite (n=16; 53.33%), chert (n=10; 33.33%), silicified siltstone (n=2; 6.67%), and quartz (n=1; 3.33%). The recovery of a silicified volcanic ash secondary flake (n=1; 3.33%) from level two allowed incorporation of this ring into the McKean Complex.

Firebroken rock was recovered from all five levels excavated. A total of 20 (5.00 items / sq m) pieces of firebroken rock with a combined weight of 2833 grams were obtained. Of this total, 16 (4.00 items / sq m; 80.00%) pieces with a combined weight of 1877 grams (66.25%) were recovered from the ring levels, while the remaining 4 (2.00 items / sq m; 20.00%) pieces with a combined weight of 956 grams (33.74%) came from levels four and five. Within the ring levels, level one yielded 2 (0.50 items / sq m; 12.50%) of these pieces with a combined weight of 707 grams (37.67%), level two yielded 10 (2.50 items / sq m; 62.50%) with a combined weight of 576 grams (30.69%), and 4 (1.00 items / sq m; 25.00%) pieces with a combined weight of 594 grams (31.64%) came from level three. Of the four pieces that came from levels four and five, 2 (1.00 items / sq m; 50.00%) with a combined weight of 486 grams (50.84%) came from level four, and 2 (2.00 items / sq m; 50.00%) with a combined weight of 470 grams (49.16%) came from level five.

As only one 2 metre X 2 metre unit was excavated, data pertinent to a discussion of patterning was not recovered.

vi) Activity Area (Ring 33h)

In addition to the five McKean Complex rings described above, a McKean Complex activity area was also excavated. This activity area is ascribed to the McKean Complex on the basis of the recovery of 4 McKean lanceolate points. This activity area lies below ring 33h, also ascribed to the McKean Complex on the basis of the recovery of a Hanna point. Although artifacts were recovered at depths ranging from the transitional level, level three (10 to 15 cms BS), through level seven (30 to 35 cms BS) the main occupation level as determined through provenience data occurs between 19 and 22 centimetres below surface and dips slightly to the southeast (Plate 4). Although some artifacts recovered from level three are contemporaneous with the ring, for reasons discussed above (see ring 33h) these artifacts, with the exception of the Hanna point, are grouped with the activity area rather than the ring.

As can be seen from Figures 15 to 18 and Plate 5, the depth to basal gravel was highly variable within the 32 square metre area

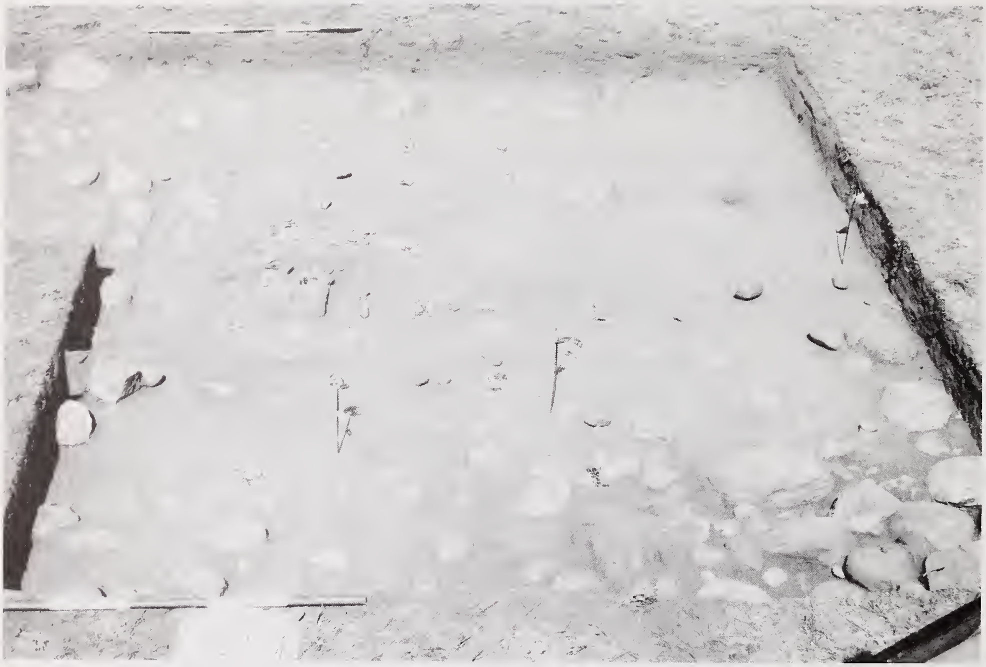

Plate 4 DlPb-2, Ring 33h, McKean activity area. Main occupation level, 19 - 22 cm BS (level 4 - 5), General view north.

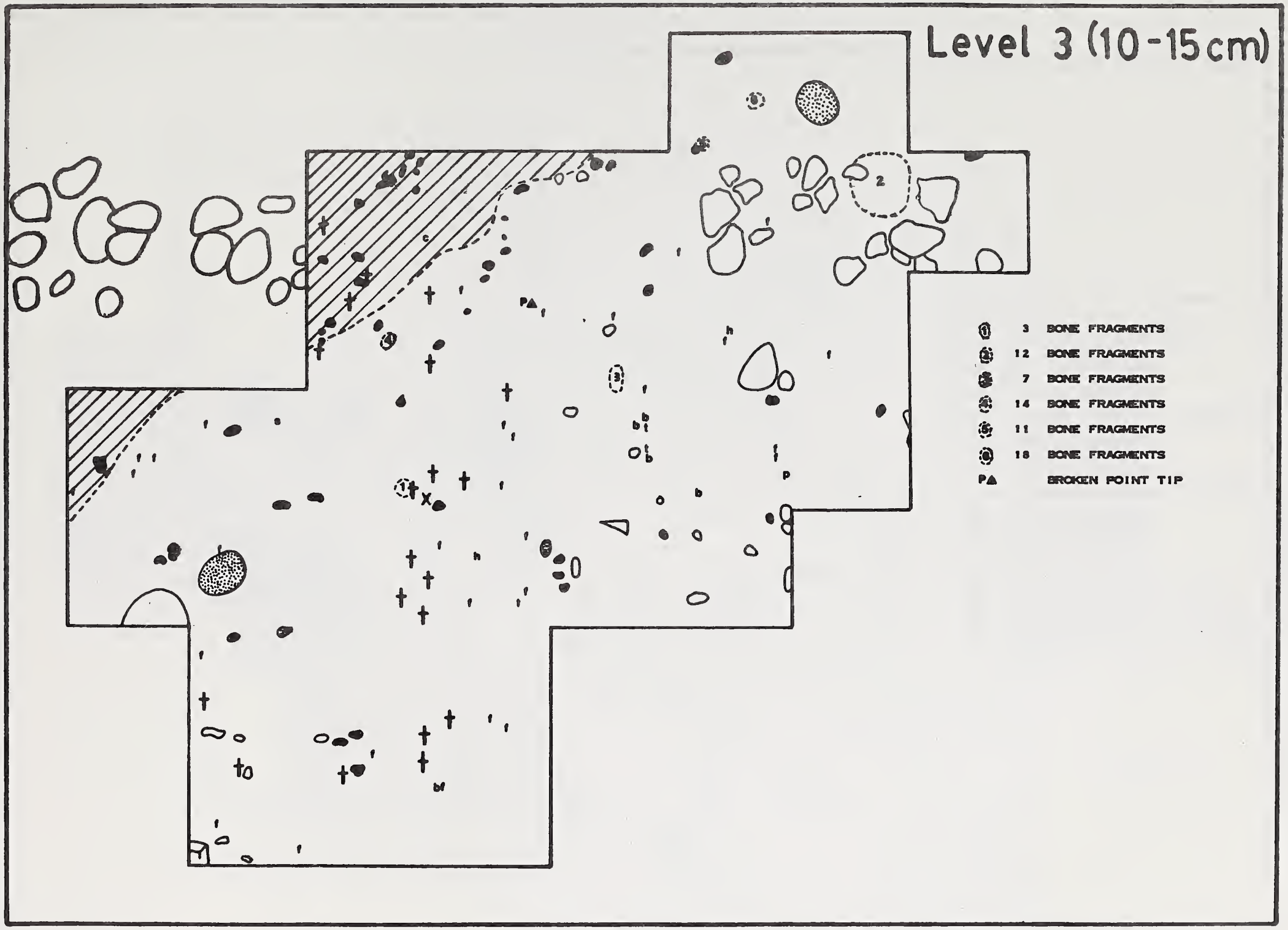

Figure 15 Feature Map, Ring 33h, Level 3

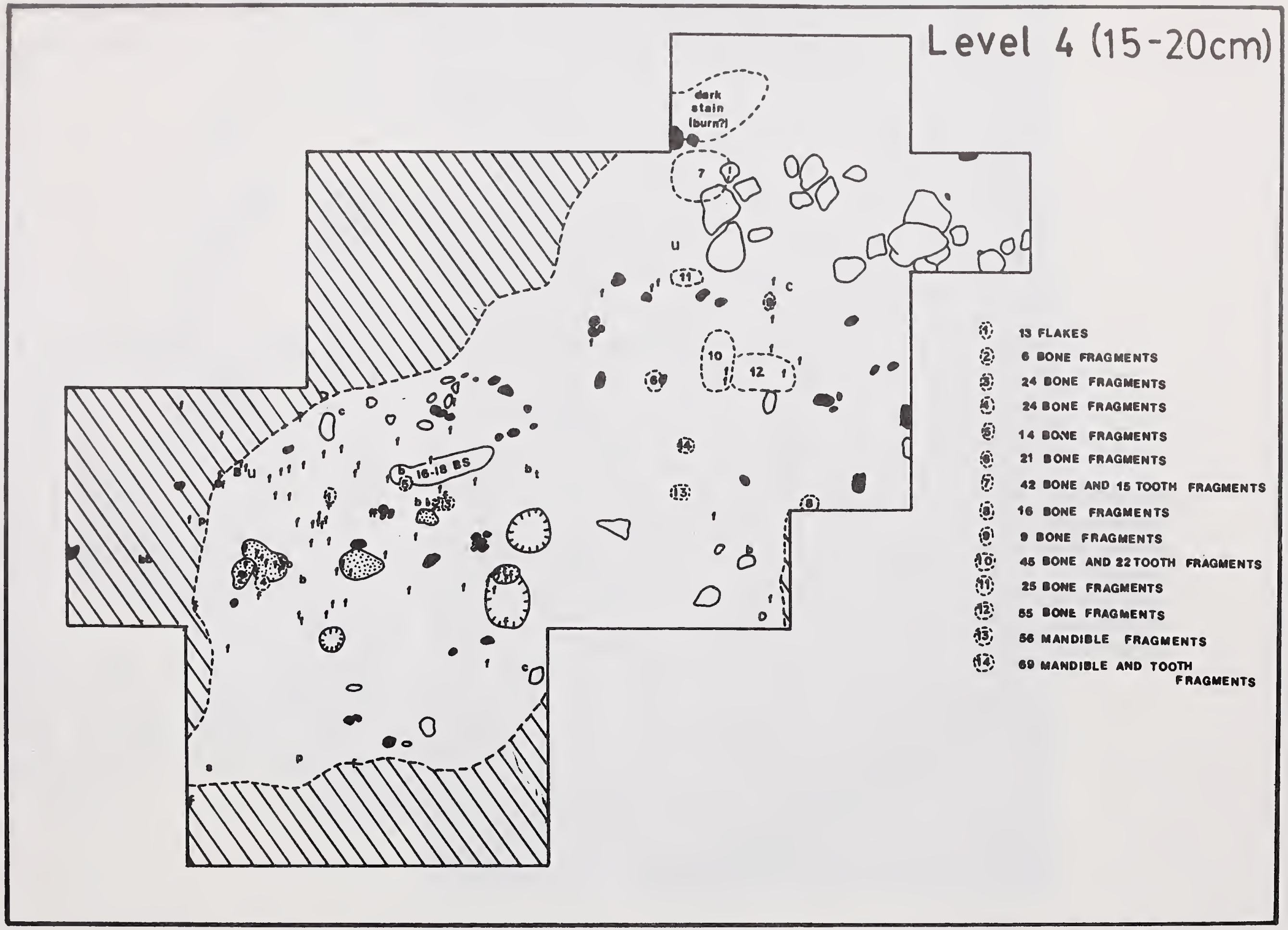

Figure 16 Feature Map, Ring 33h, level 4

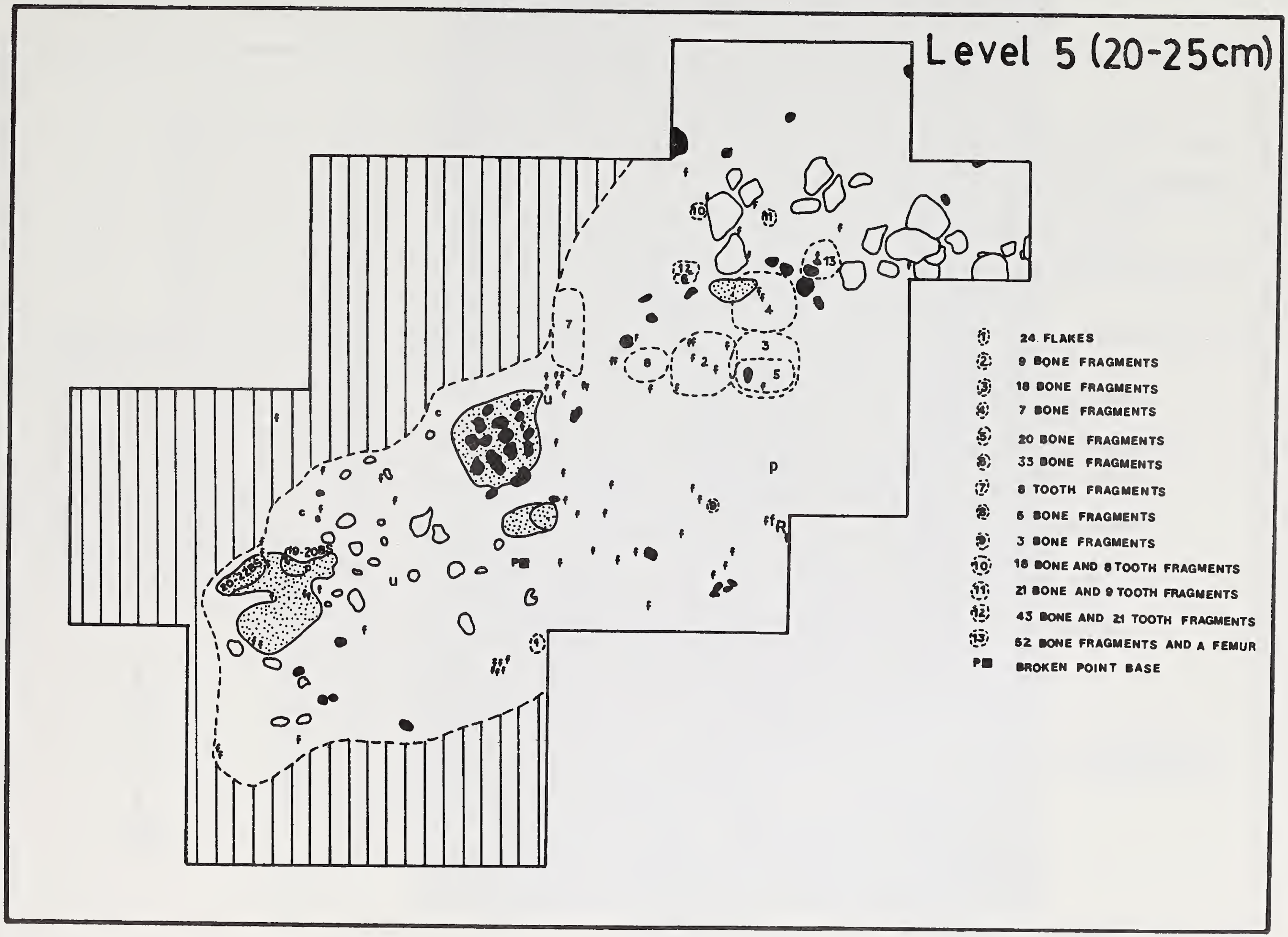

Figure 17 Feature Map, Ring 33h, Level 5

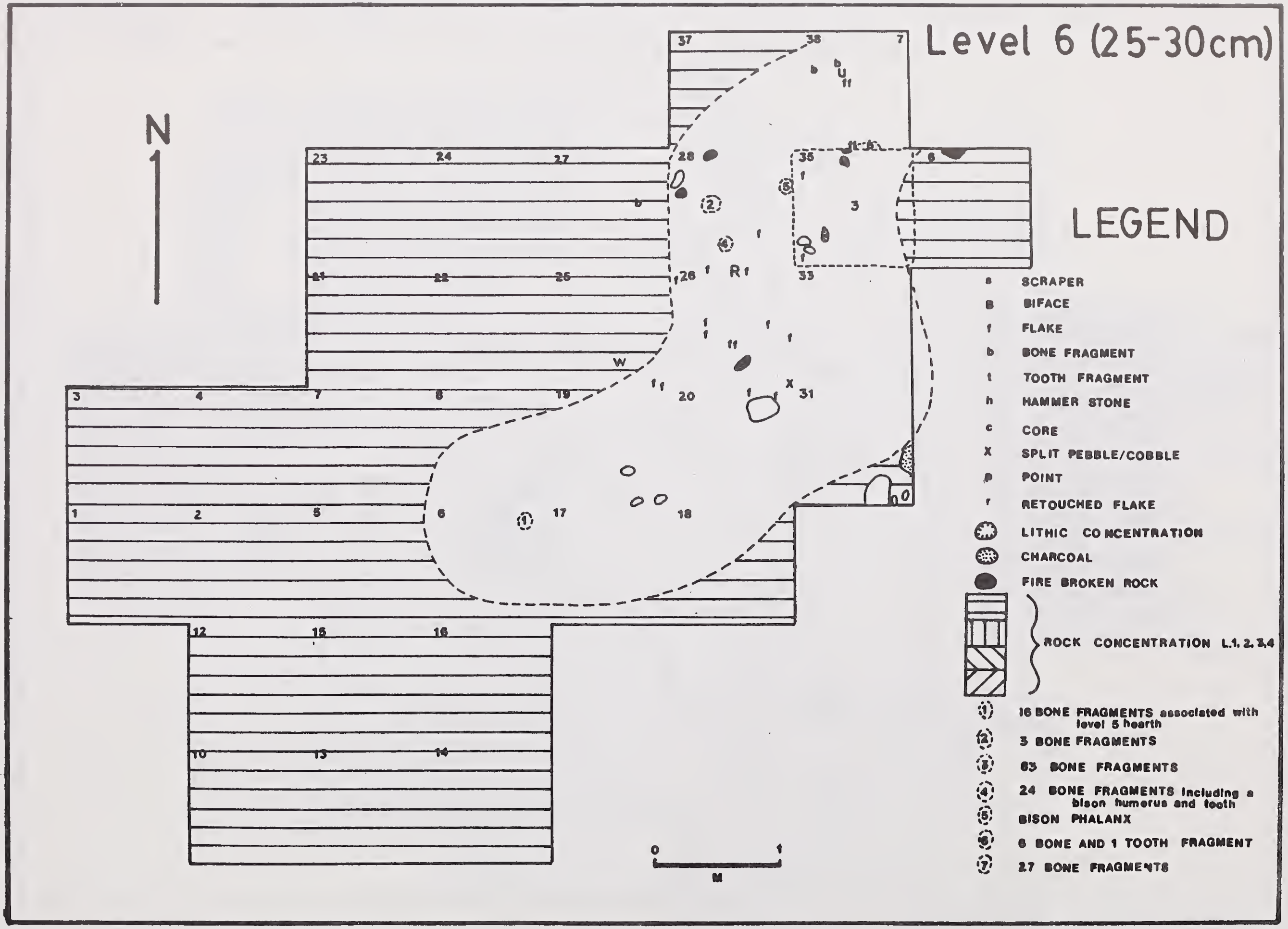

Figure 18 Feature Map, Ring 33h, Level 6

Plate 5 DlPb-2, Ring 33h, McKean activity area. General view north of completed excavations.

excavated. As a result, not all levels had equivalent amounts of excavation: level three was excavated with 32 square metres, level four with circa 25 square metres, level five with circa 22 square metres, level six with circa 12 square metres, and level seven with circa 5 square metres. As a result for levels four through seven the number of items per square metre is approximate as a result of removing from consideration those units excavated to basal gravel. In some cases it was necessary to estimate what percentage of the unit was excavated and what was not; this will add a small degree of error to the calculations of artifact density.

The distribution of artifacts by artifact type *versus* raw material is summarized in Table 14. All cultural material found *in situ* is diagrammed by level (Figures 15 to 18). In addition, the location of the overlying ring rocks has been marked on Figure 15. A total of 614 (19.18 items / sq m) lithic artifacts were recovered from the ring 33h activity area, of which 75.08% (n=461; 14.41 items / sq m) were recovered in situ. Level three, not including the Hanna point, yielded 144 (4.50 items / sq m; 23.45%) lithic artifacts, level four yielded 210 (8.40 items / sq m; 34.20%) lithics, level five 201 (9.14 items / sq m; 32.74%) lithics, and level six 59 (4.92 items / sq m; 9.61%)

	QTZITE	S.A.	Ind.	Pebble	CHERT Ether-ington	Swan River	Montana	Avon	KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 33h: Levels 3 - 6																						
Projectile Points[1]	1	2					1					2				1						7
Bifaces			1																			1
Piece Esquilles/Wedges				1																		1
Unifaces																						
Chopping Tools	2																					2
Scrapers (End/Side)			3								1											4
Retouched Flakes	2		3								1	1	2									9
Utilized Flakes	1		4	1								2		1		1						10
Cores/Core Frags.	4													1								5
Decortication Flakes																						
Primary	24		15											7								46
Secondary	36		17											12								65
Waste Flakes																						
Shatter	17	2	31							1				22		17						90
Block Fracture													6									6
Secondary Flakes	111	8	71		1		1		3	3		1		14		5						218
Thinning	21	5	40	1			1		4	10	13	2		3		24						124
Resharpening																1						1
Retouch	4		10							1						7						22
Edge Preparation																						
Core Rejuvenation																						
Core Preparation			1																			1
Indeterminate																						
Hammerstones/Anvils	2																					2
Split Pebbles/Cobbles	1																					1
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	226	17	196	3	1		3		7	15	15	8	8	60		56						615

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

Table 14 Frequency of Artifacts Recovered by Material, McKean Activity Area.

lithics. No lithic artifacts were recovered from level seven.

Of the four lanceolate points recovered, one point (DlPb-2:5147 / 7210) in two pieces was recovered from levels 3 and 5, another point from level three (DlPb-2:6859), one from level four (DlPb-2:6940), and one from level five (DlPb-2:5148). In addition, the base of a small side notched obsidian point (DlPb-2:5159) was recovered from level five. This point is likely intrusive; a result of bioturbation and congeliturbation. The presence of the tip of one of the points in unit 22, level three, and the base 8 centimetres lower in unit 6, level five also documents some degree of turbation. However, the patterning evident in the distribution of the cultural material leads me to suggest that the overall amount of turbation was slight.

Lithic raw materials recovered from the activity area include quartzite (n=226; 36.87%), assorted unsourced cherts (n=196; 31.92%), quartz (n=60; 9.77%), obsidian (n=56; 9.12%), silicified volcanic ash (n=17; 2.77%), assorted unsourced chalcedonies (n=15; 2.44%), brown chalcedony (n=15; 2.44%), silicified siltstone (n=8; 1.30%), petrified wood (n=8; 1.30%), Knife River Flint (n=7; 1.14%), pebble chert (n=3; 0.49%), Montana chert (n=2; 0.32%), and Etherington chert (n=1; 0.16%).

The faunal assemblage recovered from levels 3 through 7 totals 1502 items: 1213 (80.76%) unidentifiable unburned bone fragments, 12 (0.80%) unidentifiable burned bone fragments, 153 (10.19%) unidentifiable tooth enamel fragments, and 128 (8.52%) identifiable fragments of which 125 (97.66% of identifiable bone) comprise two *Bison bison* mandibles recovered from level five (unit 20; 10N 4E, 20-23 cms BS & unit 20; 52N 16E, 20-23 cms BS). The remaining identifiable fragments include a proximal *Bison bison* phalange from level five (unit 2; 0-50N, 50-100E, 22cms BS) a *Bison bison* phalange from level six (unit 28; 70N 95E, 28cms BS), and a left distal *Bison bison* humerus fragment from level six/seven (unit 28; 18-25N, 40-50E, 27-36 cms BS). Ten tooth fragments and 123 bone fragments (n=133; 4.16 items / sq m; 8.85%) came from level three, 392 unburned and 12 burned bone fragments plus 59 tooth enamel fragments (n=463; 18.52 items / sq m; 30.82%) were recovered from level four, while level five yielded 457 unburned bone fragments, 57 tooth enamel fragments, a bison proximal phalange, and two bison mandibles comprised of a total of 125 fragments (n=640; 29.09 items / sq m; 42.61%). Level six produced 217 unburned bone fragments, 11 tooth enamel fragments, a bison phalange, and a bison left distal humerus fragment (n=230; 19.17 items / sq m; 15.31%) while level seven yielded

24 unburned bone fragments and 12 tooth enamel fragments (n=36; 7.20 items / sq m; 2.40%).

Excavation of the ring 33h activity area resulted in the recovery of 292 pieces of firebroken rock with a combined weight of 51670 grams. Seventy-four (2.31 items / sq m; 25.34%) pieces of firebroken rock with a combined weight of 8695 grams (16.83%) came from level three, 96 (3.84 items / sq m; 32.88%) with a combined weight of 19550 grams (37.84%) from level four, 89 (4.04 items / sq m; 30.48%) with a combined weight of 18875 grams (36.53%) from level five, 27 (2.25 items / sq m; 9.25%) with a combined weight of 3900 grams (7.55%) from level six, and 6 (1.20 items / sq m; 2.05%) with a combined weight of 650 grams (1.26%) came from level seven. This distribution helps support the supposition of the occupation level lying between 19 and 22 centimetres below surface.

Combining all cultural material groups together results in a total of 2408 (75.25 items / sq m) cultural items for the McKean activity area (Table 3). Of this total, 351 (10.97 items / sq m; 14.58%) artifacts came from level three, 894 (35.76 items / sq m; 37.13%) came from level four, 805 (36.59 items / sq m; 33.43%) from level five, 316 (26.33 items / sq m; 13.12%) from level six, and 42 (8.40 items / sq m; 1.74%) came from level seven. This distribution once again gives support for a main occupation level lying at the level four to five interface.

In order to discuss the function of the activity area, all levels are grouped together and the activity area discussed as a whole. In general, it appears that rocks were cleared from the activity area, or that there was a small natural clearing present. Of the two alternatives, the former is the more likely. A fire-spot (Plate 6) was then placed at the southwest end of the cleared area. As can be seen from Figures 15 to 18, the majority of the charcoal originated at this end of the excavated area. The presence of this charcoal, combined with the heavy staining of the soil, suggests that wood rather than bison chips was used for fuel (see Brink et al. 1986). It appears that the hearth was a surface hearth as no evidence for a pit was observed. Although more exposed than a pit hearth, and therefore more subject to wind disturbance, this increased exposure may not have been detrimental as the whole activity area was somewhat sheltered due to the removal of the cobbles. This sheltering would allow for some degree of draft to enhance burning, but prevent the draft from hampering burning.

The very small amount of burned bone *versus* unburned bone recovered from the activity area

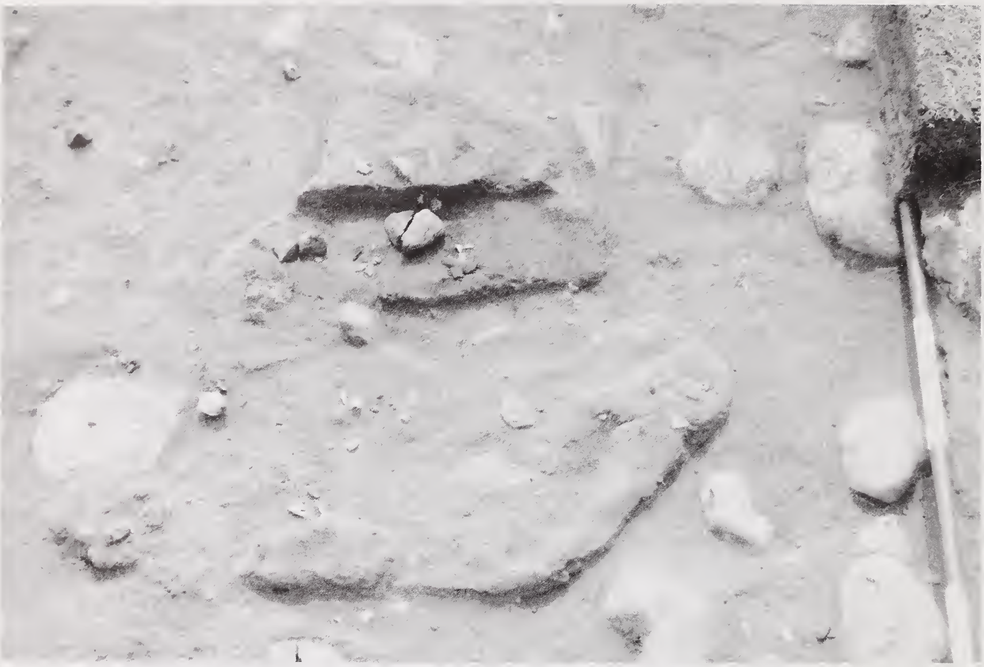


Plate 6 DlPb-2, Ring 33h, McKean Activity Area. Hearth area.

indicates that roasting meat was not a prime activity. The quantity of firebroken rock recovered, particularly from the dump at the northeast end of the hearth area (Figure 17), provides evidence suggestive of the intentional heating of rocks, possibly for stone boiling although no boiling pits were noted within the excavated area. As rapid cooling would preclude moving the rocks very far, such boiling pits, if they exist, are likely located nearby.

The high density of artifacts leads me to suggest that any stone boiling being conducted was not primarily associated with bone grease preparation. Replicative studies of bone grease preparation conducted at Head-Smashed-In Buffalo Jump indicate that bone grease preparation was an odourous task; a task not likely to be accompanied by flintknapping. Therefore I suggest that boiling prepared cuts of meat, cooking soup, making medicine, or treating meat to be dried, are more likely alternatives.

The density of fragmentary bone indicates meat processing was likely being conducted, particularly toward the northeast end of the excavated area. As can be seen from the density of flakes and tools in the activity area, flintknapping was also common. The various lines of evidence -- flintknapping, fragmentary bone, and stone boiling, in combination with seasonality of occupation (see below) -- leads me to suggest that the main activity represented may be the preparation of meat for drying. In order to enhance the speed at which meat was dried, it was frequently cut into smaller pieces and strips. This activity may be reflected in the quantity of bone recovered from the activity area. The fragmentary nature of the bone may have resulted from a combination of meat processing, post-depositional taphonomic factors, and mechanical and chemical weathering. Flintknapping may have been associated with the production of tools for meat processing, although such an association was not exclusive. Some lithic artifacts recovered, such as the points, would have little use in meat preparation. The diversity expressed in the lithic artifacts likely reflects the use of the area by both men, for the production of tools for the hunt, and women, for the production of tools used in processing the meat. Once the meat was separated from the bone and cut into pieces, it was a commonly dipped in boiling water prior to laying it out to dry. A summer to early fall occupation would be conducive to solar drying. Brumley and Dau (1988) suggest that solar radiation for drying of meat would be particularly effective during June, July and August. Although not conclusive, the cultural material recovered from the activity area may reflect part of the process of drying meat for future consumption.

At a more specific level, the quantity of cranial bone fragments likely reflects the presence of a nearby kill site as skulls are not often transported very far from the site of a kill due to the heavy weight to food ratio. Examination of the surrounding countryside resulted in the discovery of a kill site located approximately one kilometre from the tipi ring site; this site may, indeed, be related to the tipi ring site and share its long history of use.

In addition to cranial bone fragments, a number of mandible and tooth fragments were also recovered. Ethnographic records document that the tongue was a preferred portion so the number of tooth and mandible fragments may indicate removal of the tongue.

None of the bone recovered was large enough to be submitted for radiocarbon dating, and the two hearth matrix samples submitted for dating proved to be impossible to date due to contamination by fine roots. Therefore, an exact date of occupation, or a range of dates if the area reflects more than one occupation, was not able to be determined through radiocarbon analysis. Although an exact date(s) of occupation could not be determined, the general trend toward increasing cultural material density with depth until the level four to five interface is achieved followed by declining levels of cultural material, in combination with artifact proveniences documenting a concentration between 19 and 22 centimetres below surface, tends to argue in favour of a single episode of use rather than multiple episodes of use. How long this episode of use lasted can not be determined.

Comparison and Discussion

This section attempts to compare the McKean rings to each other so as to discuss the similarities and differences between the rings. A brief discussion comparing the Hanna ring, ring 33h, with the rest of the McKean rings is presented first, followed by a discussion of the McKean rings proper.

The McKean occupation of the central area of the Cranford site is well documented. Fully half of all rings that could be ascribed to a cultural complex, plus the only external activity area from which culturally diagnostic material was recovered, belong to the McKean complex. Within the McKean Complex, four rings (33d, 33g, 34d and 34g) plus the activity area all contained McKean lanceolate points, or a lithic raw material type indicative of contemporaneity with the McKean lanceolate occupation. The fifth ring, 33h, was placed in the McKean Complex on the basis of the recovery of a

Hanna point believed to be, but not conclusively demonstrated to be, associated with the ring.

A comparison of ring sizes for the five McKean Complex stone circles shows that ring 33h is much smaller than the other McKean rings. Ring 33h possesses an inside diametre of 3.52 metres and outside diametre of 3.98 metres in comparison to the other four rings which range in inside diametres from 4.55 metres to 4.88 metres, and outside diametres from 5.58 to 5.95 metres. Ring 33h is also separated from rings 34g, 33d, 33g, and 34d through the absence of silicified volcanic ash in the ring levels, plus the presence of a Hanna point rather than McKean lanceolate points. These factors, combined with the rings stratigraphic position above the McKean lanceolate point type activity area leads me to suggest ring 33h represents a separate occupation of the site.

Balcom (1987) also recovered a single Hanna point during her excavations, this one from ring WDg at the west end of the site. The point was recovered from between 20 and 30 centimetres below surface, as were points belonging to Prairie side notched, Besant, Pelican Lake, and McKean point typologies. Unfortunately, Balcom was unable to separate out occupations thereby making comparisons between rings 33h and WDg meaningless, other than to note that Hanna points have been recovered from two areas of the site.

The differences in size among the four McKean lanceolate rings is not believed to be culturally or socially significant. A greater degree of variation is noticed in the ring weights per sector. Brumley and Dau (1988) undertook empirical tests utilizing the distribution of ring rocks, combined with determination of the longest inside axis or diametre, in an attempt to determine both wind patterns at the time the tipi represented by the tipi ring was occupied, plus the location of the doorway. Based on results from Forty Mile Coulee, they (ibid) argue that the longest axis parallels anticipated wind direction for high velocity winds (and not necessarily prevailing wind direction), with the doorway and fewest rocks located at the downwind end, and the heaviest concentration of rocks at the upwind end. Amongst the McKean rings the heaviest weighting is in the north for 34g and 33g, south and southeast for 33d, and south and southwest for 34d. The longest inside axis for ring 34g is north south, but the entire variation in inside diametre in only 10 cms. For ring 33g, the north south and east west inside diametres are tied for the maximum. In rings 33d and 34d, the longest axis is north south. Lightest rock weighting is in the northwest for both ring 34g and ring 34d, and in the west for both 33g and 33d. Overall, the McKean rings provide only very limited support for Brumley and Dau's (1988) hypothesis. It is interesting to note that weather data from the Lethbridge weather station, the nearest weather station to the Cranford site from which current wind patterns are available, indicates that both the highest frequency and greatest velocity winds are generally from the west and west southwest (Brumley and Dau 1988:258), while rock weighting of the McKean rings was lightest on the west and northwest.

If only the sectors containing the greatest rock weights are analyzed, then for two of the rings, the anticipated strongest velocity winds were from the north, and two from the south. This would strongly suggest that the rings are not contemporaneous but represent at least two discrete occupations. This also represents wind patterns that are quite different from the current wind patterns. The alternative is to suggest that the model presented by Brumley and Dau (1988) is not supported by my data. I think this latter explanation to be more likely the case.

The density of lithic artifacts recovered is 15.00 items / sq m for 34g, 16.50 for 33d, 18.00 for 33g, while only 7.50 for ring 34d. No concrete explanation for this difference is apparent, although the explanation of a shorter occupation period for ring 34d is tempting. In terms of the types of artifacts present, the most significant variation amongst the rings concerns projectile points. Four points were recovered from ring 34g while no points were recovered from the remaining three rings. Although this may accurately reflect the real distribution of points, it should be remembered that ring 34g was excavated with 20 square metres, while ring 33d was excavated with only 8 square metres, and rings 33g and 34d with only 4 square metres apiece. Therefore, the fact that no points were recovered from these three rings may simply reflect sampling problems.

The relative frequencies of remaining artifact types are fairly consistent across the four rings. Ring 34d displays a relatively higher frequency of cores and core fragments (n=3; 7.14%) than the other rings (33g 0.00%, 33d 1.52%, 34g 1.00%), while 33g contains a disproportionate quantity of secondary flakes at 59.72% (n=43) in comparison to the other rings (34d 38.10%, 33d 32.58%, 34g 14.33%). However, these variations are not considered to be either culturally or socially significant, but rather reflect specific activities undertaken within the ring.

The faunal assemblage density for 34g is 11.40 items / sq m, 1.25 for 33d, 0.75 for 33g, and 0.00 for 34d. The variation seen in this spread likely reflects intra-site preservation differences, the amount of excavation conducted within each ring, as well as possible cultural, behavioural, and social factors. Overall, it appears the centre of the rings contain relatively little bone. As only the central 2m X 2m unit was excavated for 33g and 34d, it is not surprising that they have the lowest faunal density. Ring 34g, with the greatest faunal density, was most fully excavated. This pattern, although based on a small sample size, suggests intentional discard of bone away from the centre of the ring. The pattern is further reinforced by the fact that none of the McKean rings contained central hearths; any cooking done within the rings was done toward the edges, such as described for 34g.

The density of firebroken rock for 34g is 4.40 items / sq m, or 990.95 grams / sq m, 3.75 items / sq m or 667.88 grams / sq m for 33d, 6.00 items / sq m or 1925.00 grams / sq m for 33g, and 4.00 items / sq m or 469.25 grams / sq m for 34d. Conclusive reasons for such a wide ranging variance in the weight of the firebroken rock recovered per square metre of excavation are unknown, although suggestions can be made.

Complete excavation of 34g recovered a concentration of firebroken rock within a shallow pit feature suggested to have been used for cooking. The quantity of firebroken rock recovered from 33g may also be indicative of cooking inside of the tipi, even though no feature indicative of such a procedure was recovered due to limited excavation. On the other hand, the low quantities of firebroken rock recovered from 33d and 34d may be indicative of the absence of this practice. Although this is speculative, there is some support for it. In ring 34g, the cooking area was postulated to be at the eastern side of the ring. In ring 33d, excavation of the eastern 2m X 2m unit failed to produce any definitive evidence for food preparation within this area, contrary to the case for ring 34g. In ring

33g, firebroken rock tends to increase toward the east, although a slight stain was noticed in the centre of the ring. Nevertheless, the eastern orientation of the firebroken rock is clear, and this orientation is comparable to the pattern seen in 34g. Therefore, the lack of a similar pattern in ring 33d, and to a lesser extent in ring 34d, may be indicative of a lack of food preparation within these rings.

In terms of density of all cultural material recovered, ring 34g produced 30.80 items / sq m, ring 33d 21.50 items / sq m, ring 33g 24.75 items / sq m, and ring 34d 11.50 items / sq m. The density of material recovered from ring 34d is substantially lower than the quantity recovered from the other rings. Indeed, it is lower in every category. One possible reason for this, as mentioned, may simply be that the ring was not occupied for as long as the other McKean rings.

As can be seen by comparing Figures 12 and 11, the distribution differences between 33d and 34g are pronounced; ring 33d displays none of the heavy artifact concentration toward the east that ring 34g has. It is also interesting to note that the heaviest ring rock concentrations are opposed 180 degrees. Although it is highly speculative, perhaps the differences seen in ring rock concentrations reflect artifact distributions as well; the distribution apparent in the west unit of 34g may be equivalent to the east unit of 33d. Unfortunately, such a supposition will have to remain highly speculative as further work within the central area of DlPb-2 is not planned.

The cultural material density between 34g and 33g is similar, and the distribution apparent in the central 2m X 2m unit excavated in ring 33g hints at the distribution seen in ring 34g. Hence, the same pattern seen in ring 34g may also be present in 33g. It is a common axiom in archaeology that the most productive units are discovered at the end of the project making pursuit of the tantalizing results impossible. Such may also be the case with ring 33g. This ring was not tested until the end of the field program, by which time further excavation was no longer possible. So although this ring hints at the same concentration and distribution of artifacts as seen in 34g, the possibility was not able to be pursued.

The greatest range of raw material types was recovered from ring 34g with 12 different material types. The dominant material type consists of various quartzites comprising 54.33% of the assemblage, cherts at 30.67%, and all other material types (N=10) representing 14.33% of the assemblage. Ring 34d contained a similar make-up with quartzite dominating at 53.33%, chert second at 33.33%, with the three remaining material types composing 13.33% of the assemblage. Ring 33d was also dominated by quartzite at 59.85% with chert second, but at a relatively lower value of 18.18% of the assemblage.

The remaining six constituents of the assemblage make up 21.97%. This higher value for ‘other’ material types is increased due to the relatively higher value for silicified siltstone at 8.33% of the assemblage (34g = 1.67%; 33g = 0.00%; 34d = 6.67%). Ring 33g displays the highest level of quartzite at 79.17% of the assemblage, with chert comprising only 8.33% of the assemblage, while massive quartz is relatively strongly represented at 6.94% of the assemblage.

In all four rings, quartzite is dominant with chert following second. This likely reflects relative availability of raw material. The third place is occupied by silicified volcanic ash in ring 34g, silicified siltstone in 33d and 34d, and quartz in 33g. Aside from quartzite and chert, the only material types present in all four rings are massive quartz and silicified volcanic ash. Of these two materials, the silicified volcanic ash is the most important. Of the eight McKean points recovered, five are made of this material, even though this material makes up only 4.00% of the 34g assemblage, 1.52% of the 33d assemblage, 1.34% of the 33g assemblage, and 3.33% of the 34d assemblage, or 3.00% of the combined assemblage (N=534, n=16). This suggests that a high value was placed on the material (ie. it was highly curated), and that it was not locally available. Len Hills (personal communication 1988) suggests possible sources for this material in the Crowsnest Pass near Blairmore, Black Butte on the Milk River, or Gold Butte in the

Sweetgrass Hills. Barney Reeves (personal communication 1988) believes the Crowsnest Pass to be the least likely of these possibilities, and suggests the Sweetgrass Hills as the most likely. Rich Fox (personal communication 1988) indicates that the material is fairly common in Montana, which may be indicative of a Montana source for the material. Len Hills (personal communication 1988), further suggests that the material is unique and should be able to be sourced through comparative thin-section analyses; he is preparing such a sample.

In addition to its favour for projectile point manufacture, this silicified volcanic ash is also diagnostic of the McKean occupation, at least at the Cranford Site. Of the rings containing projectile points, silicified volcanic ash was recovered only from ring 34g, as well as the 33h activity area. Given this distribution it is reasonable to conclude that silicified volcanic ash is diagnostic of McKean occupations. As a result, rings 33d, 33g, and 34d were included within the McKean assemblage.

Although the McKean Complex is composed of five rings and the activity area, for reasons discussed above, ring 33h, the Hanna ring, is not considered to be contemporary with the McKean occupation proper. The low density of material recovered from ring 33h (3.38 items / sq m) may be indicative of only a very brief occupation. The low quantity of cultural material, combined with the fact that the occupation is represented by only one ring, means very little can be said about it. As will be discussed in more detail in section 8.0, the ring probably represents a summer occupation. As will also be discussed in section 8.0, the reasons for camping at this spot reflect the availability of rocks to hold down the tipi, the nearby presence of wood and water, and the suitability of the area for hunting.

The McKean occupation reflects a greater intensity of use of the area than the Hanna occupation. Although the exact length of occupation can not be determined, given the quantity of material recovered, it was most likely longer than that of the Hanna occupation.

Rings 34g and 34d are located 20 metres from each other. This same distance lies between 33d and 33g, with the activity area located 10 metres from 33g. The distance between 34g / 34d and 33d / 33g is about 60 metres. This arrangement does suggest some degree of patterning, with 34g and 34d forming one cluster, while the activity area, 33d and 33g form the other cluster. The significance of this clustering is ambiguous. It is not reflected in similarities and differences between material assemblages, nor in density of cultural material present in each ring. In addition, it is the exact opposite of the grouping produced by rock weights per sector. Therefore, although it is tempting to suggest that 34g and 34d represent one occupation of the site, and 33d, 33g and the activity area another occupation, the evidence is inconclusive.

The McKean occupation of the Cranford site is unique in that it is the only known occupation for which an external activity area was located (an activity area located beneath ring 4g could not be culturally identified). The recovery of the activity area provides for greater scope in interpreting probable activities associated with the McKean occupation.

Although the contemporaneity of the rings can not be ascertained with certainty, at least one of them, if not all four, would be contemporaneous with the activity area. During the period of McKean occupation, it appears the site may have been used for the drying of bison meat for future consumption. There is also evidence to suggest that although meat may have been cooked within the tipi, this was done through the use of rocks heated outside of the tipi and then brought into the tipi where they were placed in a shallow pit. The meat that was prepared at the site may have come from a kill site located about a kilometre southwest of the occupation area. Supportive evidence for this is the recovery of teeth and cranial bone from the activity area.

Due to the exposed location of the site, I believe that the site would not have been occupied during the winter. The lack of foetal bone amongst the faunal collection may also indicate that the site was not occupied during the winter to spring, although the absence of this bone may also be the result of poor preservation. The small number of features suggests that this was not a communal gathering, such as would be expected for communal spring or fall hunting. Through the process of elimination, I suggest that the occupation reflects a summer occupation by a small group of hunters; perhaps an occupation consisting of only the nuclear family or of an extended family depending on how many of the four rings are contemporaneous.

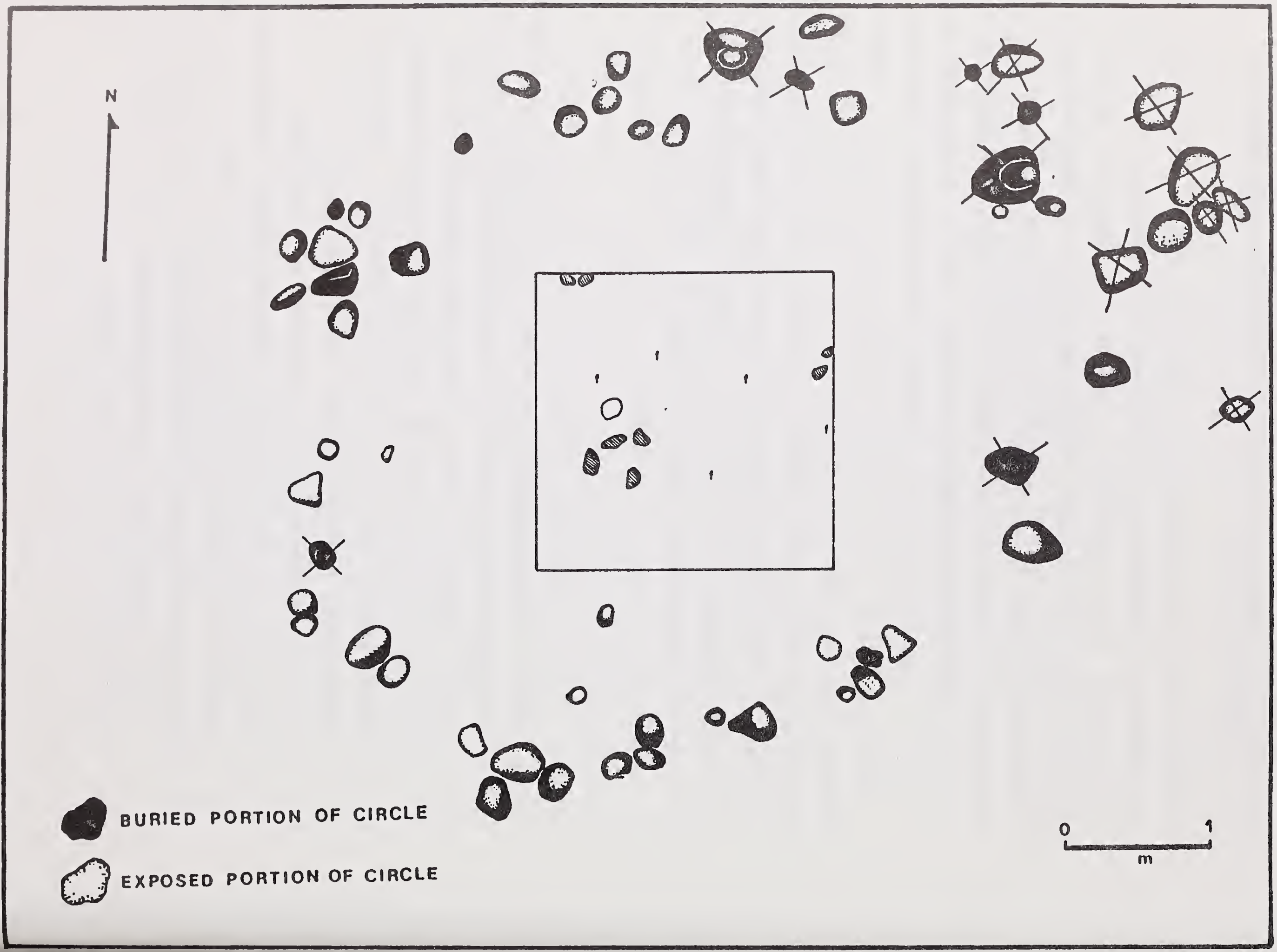
How long the site was occupied, or if the rings represent one, two, three, or four separate occupations can not be determined with certainty. Although the duration of occupation is difficult to determine, the warmer and drier climate as documented by carbon isotope analysis (Appendix A) may have resulted in an increased length of occupation by McKean people due to earlier drying out of ephemeral streams and sloughs. This would then increase the importance of major water courses, such as the Oldman River, at an earlier time in the year, thereby leading to a greater ‘use emphasis’ of the site area. The presence of the McKean activity area, and the density of material recovered from this activity area, combined with the fact that the heaviest concentration of artifacts from within a ring came from a McKean ring may be indicative on the greater reliance placed on the site area by McKean people (see also Magne 1985:257).

6.2 Pelican Lake (circa 3200 - 1900 / 1600 BP)

The Pelican Lake phase is comprised of 1 or possibly 2 stone circles. A single Pelican Lake point was recovered from ring 33c, while the body of what is believed to be either a Pelican Lake or Besant point was recovered from a possible buried component at ring 4b. Ring 4f also contained one Pelican Lake point, but three Besant points were recovered as well. The presence of these three Besant points, combined with the fairly high percentage of Knife River Flint and presence of Avon chert, both considered of importance to Besant culture (Reeves 1983), leads me to believe that the ring is more likely Besant than Pelican Lake. Therefore, the ring is discussed under the Besant section.

i) Ring 33c

Ring 33c has been ascribed to the Pelican Lake phase on the basis of the recovery of a Pelican Lake point. The ring was excavated with a total of four square metres, all excavated to a depth of 20 cms BS (level four). Separating the ring rocks from the naturally occurring gravel produces a roughly circular ring composed of 47 rocks (Figure 19 and Table 15). Rocks not believed to be part of the ring due to their location, weight and / or depth are demarcated by a superimposed X. The ring possesses an average inside diametre of 4.60


N
BURIED PORTION OF CIRCLE
EXPOSED PORTION OF CIRCLE
0
1
m

RING 33c

Diametres:		Inside	Outside	Average
	North-South	4.80m	5.70m	5.25m
	Northeast - Southwest	5.00m	5.80m	5.40m
	East-West	4.50m	5.60m	5.05m
	Southeast-Northwest	4.10m	4.80m	4.45m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)
N	1	7.5	10
	2	6	11
	3	7	12
	4	5	11
	5	8	13
	6	59	26
	7	2	6
	8	15	13
NE	9	41	20
	10	100	50
	11	7	13
	12	5.5	14
	13	1	5
E	14	6.5	14
	15	100	50
	16	7	15
	17	35	20
SE	18	10	15
	19	5	10
	20	8	13
	21	3.5	10
	22	5.5	11
S	23	9	12
	24	3.5	9
	25	5.5	14
	26	5	12
	27	11.5	17
	28	15	12
	29	2	10
	30	3	12
SW	31	22.5	16
	32	14.5	12
	33	8	11
	34	10	13
	35	11	15
SW	36	5	14
	37	7	13
W	38	22	19
	39	4	12
	40	3	16
	41	7	9
	42	9	16
	43	11	13
	44	13.5	11
NW	45	33	20
	46	12	14
	47	7	10
	48	5	11
	49	9	13
	50	8	12

Table 15 Basic Ring Data, Ring 33c

metres, and outside diametre of 5.48 metres (Table 15).

The ring rocks display a roughly uniform distribution although the eastern sectors (NE, E, SE) contain relatively few rocks. The north sector contains 7 rocks with an average weight of 7.21 kilograms (combined weight of 50.50 kgs). The northeast sector contains the second fewest rocks with 4 and an average weight of 13.62 kilograms (combined weight of 54.5 kgs). However, these weights are somewhat misleading as one rock -- rock 8 -- displays an abnormally high weight at 41 kilograms, and slightly greater depth of 20 centimetres below surface. If this rock is removed from consideration, the average weight drops to 4.50 kilograms and combined weight of 13.5 kilograms. The east sector contains 3 rocks with an average weight of 16.17 kilograms (combined weight of 48.50 kgs). However, as was the case for the northeast, one rock in this sector -- rock 14 -- also is anomalously heavy at 35 kilograms and slightly deep at 20 centimetres below surface. Removing this rock produces the values of an average weight of 6.75 kilograms and combined weight of 13.5 kilograms. The southeastern sector contains 5 rocks with an average weight of 6.40 kilograms (combined weight of 32.00 kgs). The south sector contains the greatest number of rocks at 8 with an average weight of 6.44 kilograms (combined weight of 51.50 kgs).

The southwest and west sectors each contain 7 rocks. The southwest displays an average weight of 11.14 kilograms per rock (combined weight of 78.00 kgs). The west displays an average weight of 9.93 kilograms per rock (combined weight of 69.5 kgs). The northwest sector contains 6 rocks with an average weight of 12.33 kilograms (combined weight of 74.00 kgs). This sector too contains one 33 kilogram 20 centimetres below surface rock that may not be a ring rock. In general, the west (W, NW, SW) contains the heaviest rock weighting, while the east, especially if the questionable rocks are removed from consideration, contains the lightest weighting.

Ring 33c comes closer to matching the rock weighting - wind velocity model postulated by Brumley and Dau (1988) than any of the McKean rings. The weighting on the west side of the ring, combined with the concomitant lightening of the east side does match current wind patterns. In addition, although the field ring diametre measurements do not support an east west long axis, as necessary to fulfill the model, these measurements were taken using all surficially visible rocks. Once non-ring rocks are removed, the possibility for an east west oriented long axis is enhanced (see Figure 19).

The depths of the ring rocks range from a minimum of 5 (n=1) to a maximum of 20 (n=3) centimetres below surface, although there is some question as to whether the three 20 centimetre deep rocks are actually ring rocks or not. The mean depth of burial for the ring rocks is 12.85 while the modal depth is 12/13 centimetres below surface. When combined with cultural material provenience data for the ring this indicates that the living floor was located between 8 and 13 centimetres below present ground level, although likely closer to 13 centimetres below surface than to 8 centimetres below surface. The distribution of the cultural material (Table 3) also indicates that all material recovered from excavation of ring 33c is also likely associated with the ring, even though turbation has displaced the material from the original living floor.

All cultural material recovered is summarized in Table 3. A total of 34 (8.50 items / sq m) cultural items were recovered from excavations conducted at ring 33c. Of this total, 26 (6.50 items / sq m; 76.47%) items came from level two, 7 (1.75 items / sq m; 20.59%) from level three, and 1 (0.25 items / sq m; 2.94%) from level four. No cultural material was recovered from level one.

The distribution of lithic artifacts by artifact type and raw material is summarized in Table 16. Only 10 (2.5 items / sq m) lithic artifacts were recovered from the ring, 4 (1.00

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Ring 33c: All Levels																						
Projectile Points[1]													1									1
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary																						
Secondary	1																					1
Waste Flakes																						
Shatter																						
Block Fracture																						
Secondary Flakes	2		3							1												6
Thinning										1												1
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone	1																					1
Indeterminate																						
Total	4		3							2			1									10

---

[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 16 Frequency of Artifacts Recovered by Material, Ring 33c

items / sq m; 40.00%) from level two, 5 (1.25 items / sq m; 50.00%) from level three, and 1 (0.25 items / sq m; 10.00%) from level four. Lithic raw materials recovered include quartzite (n=4; 40.00%), chert (n=3; 30.00%), chalcedony (n=2; 20.00%), and petrified wood (n=1; 10.00%).

One of the more interesting items recovered is a grinding stone. Although recent research has begun to investigate possible plant utilization among McKean groups (see Latady and Dueholm 1985; Keyser 1986), little documentation of the use of floral resources by Pelican Lake groups has been recovered. Indeed, Reeves (1983:90) states

> "The almost total lack of grinding slabs and handstones in the Pelican Lake regional subphases north of Wyoming indicates that little reliance was placed on gathering or growing plants which required grinding"

Therefore the presence of this grinding stone and the possible indication of plant utilization is significant. However, the floral association is by no means certain, grinding stones could have been used for grinding of bone during the course of producing bone meal. But, the lack of any faunal remains from ring 33c suggests that the stone was not likely used for grinding bone, although other domestic uses are still possible.

A total of 24 pieces of firebroken rock with a combined weight of 3537 grams were recovered from the ring. Of these 24 items, 22 (5.50 items / sq m; 91.67%) with a combined weight of 2845 grams (80.44%) were recovered from level two, while 2 (0.50 items / sq m; 8.33%) pieces of firebroken rock with a combined weight of 692 grams (19.56%) came from level three. No firebroken rock was recovered from either level one or four.

All material recovered *in situ* is plotted on Figure 19. As only a central 2 metre X 2 metre unit was excavated, and only 10 artifacts recovered, a discussion of artifact distribution is unwarranted. Although the distribution of firebroken rock hints at a central hearth, no charcoal or soil staining were noted thereby suggesting the arrangement to be fortuitous.

6.3 Sandy Creek (circa 3000 - 1800 BP)

The Sandy Creek occupation of the site is limited to one buried component laying below ring 321 where a point base tentatively identified as Sandy Creek was recovered. This occupation is also unique in that it is the only occupation that has been radiocarbon dated. A hearth matrix sample was recovered from unit twenty, level five, at 22 to 24 centimetres below surface. This sample was subsequently dated to 2550 ± 90 BP (AEC-475C), and therefore falls within the Sandy Creek timeframe.

i) Ring 321

The Sandy Creek component of this ring encompasses levels 4 through 7, and was excavated with a total of 16 square metres. Units 1 to 8 and 14 were excavated through seven levels (35cm BS), unit 11 through four levels (20cm BS), unit 12 through five levels (25cm BS), and units 13 and 17 to 20 through 6 levels (30cm BS). Units 9, 10, 15, and 16 were excavated through three levels only, at which time basal gravel was reached, and therefore did not encounter the buried Sandy Creek component.

Analysis of provenience data indicates that the living floor was located between 18 and 24 centimetres below present surface, although material, particularly bone and firebroken rock, continued through to 35 centimetres below surface in some units. Little material seems to have moved upward; from 15 to 18 below surface only a few isolated items were recovered. This also means that little of the overlying ring material has been displaced downward. In general, the separation between the two components is fairly well demarcated.

All material recovered from ring 321 is summarized in Table 3. In total, 375 cultural items were recovered from the Sandy Creek component. Of this total, 98 (6.12 items / sq m; 26.13%) items were recovered from level four, 131 (8.73 items / sq m; 37.93%) from level five, 67 (4.78 items / sq m; 17.87%) from level six, and 79 (8.78 items / sq m; 21.07%) from level seven. The high density of items recovered from level seven results from a fairly high quantity of firebroken rock and bone in comparison to a small amount of excavated area; only 9 of 16 units excavated reached level seven, the other units having already struck basal gravel. Although one could argue that the density of material recovered from level seven is indicative of a separate third component, I do not believe this to be the case. Rather, I believe the material in level seven reflects downward movement of artifactual material as a result of bioturbation and congeliturbation.

The distribution of lithic artifact type *versus* raw material type for the Sandy Creek levels is summarized in Table 17. Sixty one (3.81 items / sq m) lithic artifacts were recovered from the four levels. Twenty five (1.56 items / sq m; 40.98%) of the lithic artifacts were recovered from level four, 22 (1.47 items / sq m; 36.06%) from level five, 9 (0.64 items / sq

Ring 321: Level 4 - 7	QTZITE	S.A.	Ind.	Pebble	CHERT Ether-ington	Swan River	Montana	Avon	KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Projectile Points[1]			1																			1
Bifaces																						
Piece Esquilles/Wedges				1																		1
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes	1															1						2
Utilized Flakes	1		1																			2
Cores/Core Frags.			1																			1
Decortication Flakes																						
Primary	11		1							2				2								16
Secondary	2		4							1						1						8
Waste Flakes																						
Shatter	3		3											1								7
Block Fracture																						
Secondary Flakes	4		3									1		1		5						14
Thinning	1		3													1						5
Resharpening																						
Retouch			1							1						2						4
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	23		18	1						4		1		4		10						61

---

[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 17 Frequency of Artifacts Recovered by Material, Ring 321, Sandy Creek

m; 14.75%) from level six, and 5 (0.56 items / sq m; 8.20%) items from level seven.

Lithic raw materials recovered from the component include quartzite (n=23; 37.70%), assorted cherts (n=18; 29.51%), obsidian (n=10; 16.39%), chalcedony (n=4; 6.56%), quartz (n=4; 6.56%), pebble chert (n=1; 1.64%), and silicified siltstone (n=1; 1.64%). Although obsidian was recovered from a number of rings, it is from this component that it reaches its highest density; only for this component does obsidian rank third in frequency of occurrence.

The faunal assemblage consists of a total of 206 unburnt unidentifiable bone fragments, 1 burnt unidentifiable bone fragment (although several very tiny burnt fragments were noted but were too small to recover), 2 *Bison bison* mandible fragments, and 10 *Bison bison* tooth fragments for a total of 219 faunal elements. Of this total, 68 unburnt fragments, the one burnt fragment, and the 2 bison mandible fragments were recovered from level four (n=71; 4.44 items / sq m; 32.42%). Level five yielded 75 (5.00 items / sq m; 34.25%) bone fragments, level six produced 35 bone fragments and 1 bison tooth (n=36; 2.57 items / sq m; 16.44%), while 28 bone fragments and 9 bison tooth fragments were recovered from level seven (n=37; 4.11 items / sq m; 16.89%). Although this faunal assemblage is too fragmentary to allow for analysis of butchering patterns or calculations of MNIs, it is still one of the more significant assemblages recovered simply because in contains elements suitable for speciation; all being *Bison bison*.

A total of 95 pieces of firebroken rock with a combined weight of 24090.5 grams were recovered from the Sandy Creek component. Only 2 (0.12 items / sq m; 2.10%) pieces of firebroken rock with a combined weight of 954 grams (3.96%) were recovered from level four, 34 (2.27 items / sq m; 35.79%) pieces with a combined weight of 11110 grams (46.12%) from level five, level six yielded 22 (1.57 items / sq m; 23.16%) pieces with a combined weight of 5548.5 grams (23.03%), while 37 (4.11 items / sq m; 38.95%) pieces with a combined weight of 6478 grams (26.89%) were recovered from level seven.

The type of material recovered, and the distribution of this material, is indicative of a general use area. It is conceivable that the material may have been recovered from within a buried ring but no data either for or against this supposition was obtained.

6.4 Besant (circa 2500 - 1250 BP)

The Besant phase is comprised of 2 or possibly 3 stone circles. Besant points were recovered from ring 4g (Balcom 1987:60) and ring 4f, while the body of what is believed to be either a Pelican Lake or Besant point was recovered from ring 4b. However, the lithic raw material assemblage recovered from 4b more likely reflects a Pelican Lake than Besant component. A hearth matrix sample submitted to Alberta Environment Centre, Environmental Isotopes Section from ring 4f could not be dated due to fine root contamination.

i) Ring 4f

Ring 4f presents a bit of a dilemma due to the presence of one Pelican Lake point and three Besant point bases. Within the Rocky Mountains and Alberta foothills, the association of Kootenay Plains Side Notched points (Reeves 1974), points very similar to Besant points, with Pelican Lake points may explain the "mixed" assemblages recovered from these areas (Van Dyke and Head 1983). However, as the Cranford site is located well away from the foothills, the points recovered are not likely to be of Kootenay origin. Reeves (1983:94) indicates that a combination of Pelican Lake and Besant points is not uncommon, but "only Stelzer and Ruby are single component sites, without underlying components which are attributable to Pelican Lake". I believe the point is in correct association as there is no evidence for a buried component below the ring. Its presence in this ring may simply be due to one of the tipis' inhabitants finding it elsewhere at the site, picking it up, bringing it back to his own tipi, where it was subsequently lost or intentionally discarded. However, the possibility of an actual Pelican Lake - Besant interaction should not be categorically ruled out (see Vickers 1986).

Ring 4f, excavated with a total of 20 square metres, is roughly oval in shape and somewhat disturbed toward the north (Figure 20). All units were excavated to either basal gravel or until sterile deposits were reached, whichever came first. Units 9 to 12 were excavated through two levels (0 to 10 cms BS) at which point basal gravel was reached. Units 1 to 3, 5, 6, 8, and 17 to 19 were excavated through three levels (0 to 15 cms BS) at which point basal gravel was reached. Units 4 and 7 were excavated through four levels (0 to 20 cms BS) and then terminated as the level was sterile. Units 13, 15, 16 and 20 were excavated through four levels at which point basal gravel was reached. Unit 14 was excavated through five levels (0 to 25 cms BS) at which point basal gravel was reached.

The ring possesses an average inside diametre of 2.98 metres and outside diametre of 4.8 metres (Table 18). The inside diametre value is artificially small due to displaced ring rocks in the northern half of the ring. The ring is composed of a total of 34 stones,

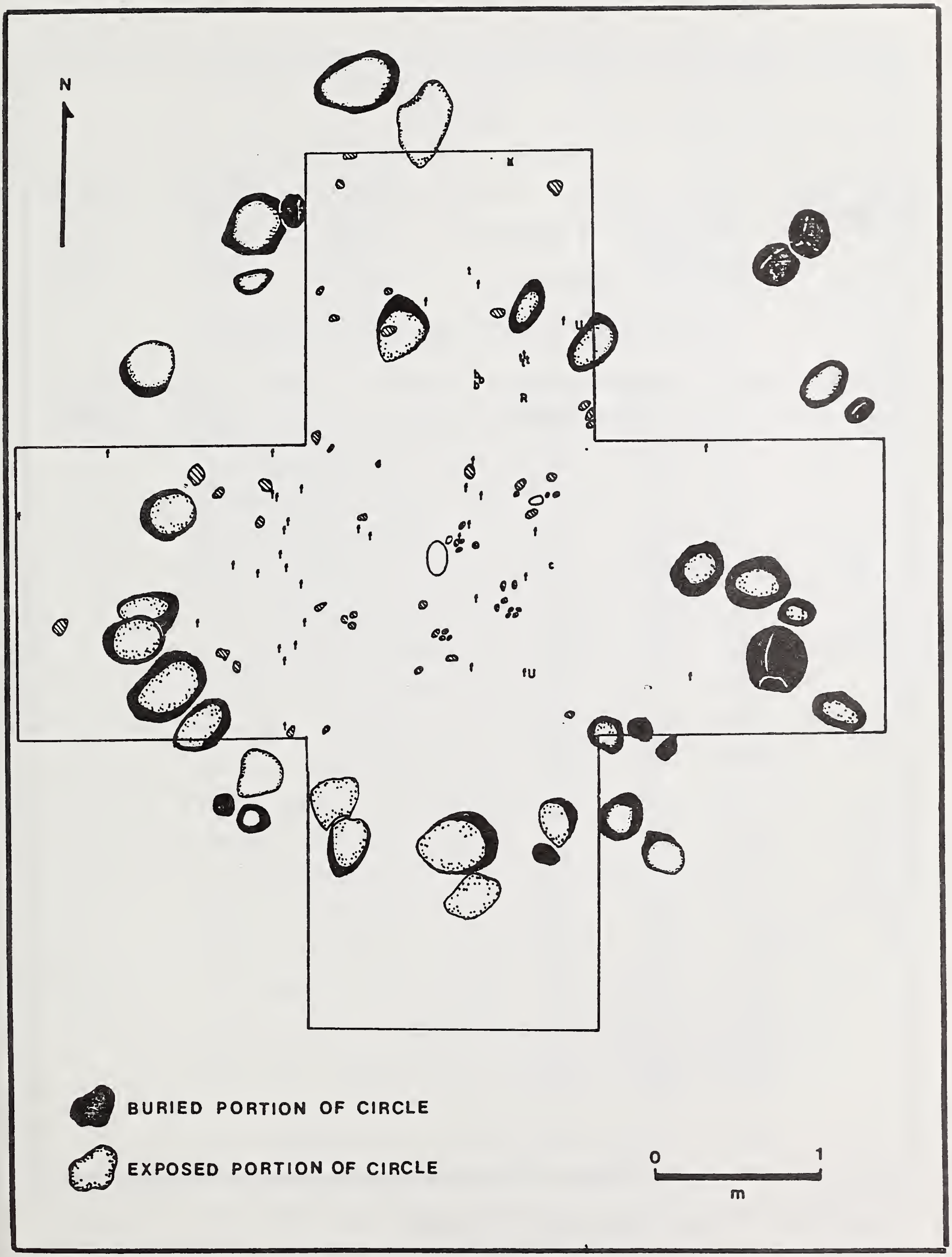


Figure 20 Feature Map, Ring 4f

RING 4f

		Inside	Outside	Average
Diametres:	North South	2.8m	5.2m	4.0m
	Northeast - Southwest	2.9m	3.7m	3.3m
	East-West	3.2m	3.9m	3.6m
	Southeast-Northwest	3.0m	4.3m	3.6m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	2	9	W	28	29	14
	2	31	14		29	16	13
	3	29	13		30	15	13
	4	21	14		31	30	14
	5	16	12	NW	32	28	14
NE	6	13	10		33	12.5	14
	7	15	13		34	45	25
	8	5	11				
N	9	15	12				
	10	16	14				
	11	3	10				
	12	11	11				
SE	13	18	15				
	14	5	12				
	15	4	8				
	16	9	10				
	17	16	13				
	18	17	11				
S	19	5	8				
	20	15	10				
	21	31	10				
	22	16.5	10				
SW	23	21.5	10				
	24	2.5	6				
	25	4.5	11				
	26	42	22				
	27	27	14				

Table 18 Basic Ring Data, Ring 4f

although two of these stones -- 26 & 34 -- are probably naturally occurring (Table 18). Five of the rocks, with an average weight of 19.80 kilograms (combined weight of 99.00 kg) are located in the north. Three rocks, with an average weight of 11.00 kilograms (combined weight of 33.00 kg) are located in the northeast. Four rocks, with an average weight of 11.25 kilograms (combined weight of 45.00 kg) came from the east sector. The greatest number of rocks came from the southeast with an average weight of 8.66 kilograms (combined weight of 52.00 kg). Four rocks, with an average weight of 16.88 kilograms (combined weight of 67.50 kg) were located in the south. The southwest also had four rocks, these with an average weight of 13.88 kilograms (combined weight of 55.50 kg). Four rocks with an average weight of 22.50 kilograms (combined weight of 90.00 kg) were also recovered from the west. The northwest contained the least number of rocks with two at an average weight of 20.25 kilograms (combined weight of 40.50 kg). In terms of weight, the north contained the greatest quantity of rock, while the northeast contained the least. Such a distribution does not support the Brumley and Dau rock weighting *versus* wind hypothesis.

The depths of the ring rocks range from a minimum of 6 (n=1) to a maximum of 15 (n=1) centimetres below surface, with a mean depth of

11.66 and modal depth of 14 centimetres below surface. When combined with cultural material distributions for the ring (Table 3), it is obvious that the main ring level is level three (10 to 15 cms BS). Within this level artifacts appear to be clustered between 12 and 13 centimetres below surface, suggesting that this is the depth of the original living floor.

Although the original living floor is contained within level three, artifacts were recovered from levels one through five. The few artifacts recovered from levels four and five gives the initial impression that they are likely contemporaneous with the ring, but have been displaced downward. However, as only 7 units were excavated through four levels, and only one through five, these few artifacts produce relatively high density values. Nevertheless, the conclusion of ring contemporaneity still has merit as the number of artifacts are few. It also seems more likely to me that a few artifacts were subjected to post-depositional downward movement than postulating a buried component deposited by people cohabiting with large cobbles. The lower artifact densities for levels one and two leads me to suggest that their vertical position was likely the result of post-depositional upward movement. In addition, the lithic raw material assemblage recovered from levels one and two is consistent with that of level three. Therefore, it is safe to assume that the artifacts from levels one and two, and four and five are contemporaneous with the ring, but have suffered from post-depositional bioturbation and congeliturbation.

All material recovered from ring 4f is summarized in Table 3. In total, 183 (9.15 items / sq m) cultural items were recovered from the ring. Of this total, 6 (0.30 items / sq m; 3.28%) items came from level one, 32 (1.60 items / sq m; 17.49%) from level two, 129 (8.06 items / sq m; 70.49%) from level three, 15 (2.14 items / sq m; 8.20%) from level four, and 1 (1.00 items / sq m; 0.55%) item from level five.

The distribution of lithic artifacts by artifact type *versus* raw material is summarized in Table 19. A total of 97 (4.85 items / sq m) lithic artifacts were recovered from 4f, of which 52.58% (n=51; 2.55 items / sq m) were recovered *in situ*. The most interesting aspect of the lithic assemblage is the presence of four points (4.12% of the assemblage); a relatively high point incidence. Whether or not it is significant that the three Besant points were broken and the one Pelican Lake point complete is unknown.

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Ring 4f: All Levels																						
Projectile Points[1]			1						1	1	1											4
Bifaces																1						1
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes			1								1											2
Utilized Flakes			1						3			1										5
Cores/Core Frags.									1													1
Decortication Flakes																						
Primary	2									1				1								4
Secondary	5		1						2													8
Waste Flakes																						
Shatter	2		2						1		2	1		2								10
Block Fracture													1									1
Secondary Flakes	8		3				1	2				2		2								18
Thinning	3		7				6		10	5	5	2										38
Resharpening																						
Retouch									1	1	2											4
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble	1																					1
Grinding Stone																						
Indeterminate																						
Total	22		15				7	2	19	8	11	6	1	5		1						97

---

[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 19 Frequency of Artifacts Recovered by Material, Ring 4f

The vast majority of the lithics came from level three (n=69; 4.31 items / sq m; 71.13%). Level one contained 5 (0.25 items / sq m; 5.15%) items, level two yielded 11 (0.55 items / sq m; 11.34%) items, level four also yielded 11 (1.57 items / sq m; 11.34%) items, while level five contained only 1 (1.00 items / sq m; 1.03%).

Lithic raw materials recovered from the ring include quartzite (n=22; 22.68%), Knife River Flint (n=20; 20.61%), assorted cherts (n=15; 15.46%), a brown chalcedony very similar to Knife River Flint but lacking inclusions (n=11; 11.34%), Montana chert, (n=7; 7.22%), chalcedony (n=8; 8.24%), silicified siltstone (n=6; 6.18%), quartz (n=5; 5.15%), Avon chert (n=2; 2.06%), petrified wood (n=1; 1.03%), and obsidian (n=1; 1.03%). The high percentage of Knife River Flint, especially in light of the attempt to separate out non-Knife River Flint brown chalcedony, is common in Besant assemblages. The presence of Avon chert, although in a limited quantity, is also characteristic of Besant assemblages.

The faunal assemblage consists of a total of 30 (1.5 items / sq m) unidentifiable bone and tooth fragments. Two bone fragments and 10 tooth fragments (0.60 items / sq m; 40.00%) were recovered from level two, while 18 tooth fragments (1.12 items / sq m; 60.00%) were recovered from level three.

A total of 56 (2.80 items / sq m) pieces of firebroken rock with a combined weight of 5034.5 grams were recovered from excavation of ring 4f. Only 1 (0.05 items / sq m; 1.78%) small piece with a weight of 2 grams (0.04%) was obtained from level one, while 9 (0.45 items / sq m; 16.07%) pieces with a combined weight of 747 grams (14.84%) were recovered from level two. Level three produced the majority of the firebroken rock at 42 (2.62 items / sq m; 75.00%) pieces with a combined weight of 2935.5 grams (58.30%). A total of 4 (0.57 items / sq m; 7.14%) items with a combined weight of 1350 grams (26.81%) were recovered from level four. No firebroken rock was recovered from level five.

Figure 20 indicates that the general trend in artifact distribution is toward the centre, the west, and the north. However, the arrangement is not distinctive. No concentrations of firebroken rock, or other cultural material were noted. However, a slight staining of the earth, and dispersed amounts of charcoal indicate the ring probably contained a central hearth. Nevertheless, the overall distribution of material is such that it appears to have suffered from a fair degree of post-depositional non-cultural displacement.

ii) Ring 4g

Ring 4g was excavated with a central 2m X 2m unit by Balcom in 1986, and with adjacent 2m X 2m units to the north, south, east and west in 1987. Balcom (1987) classified the ring as Besant on the basis of the recovery of a Besant point from 12 to 17 centimetres below surface.

All units excavated during 1987 were excavated to basal gravel. Units 1 to 4, located immediately to the east of Balcoms' central unit (see Figure 21), were excavated through seven levels (35cms BS). Units 5 to 8, located south of the central unit, were excavated through six levels (30cms BS). Units 9 to 12 were located north of the central unit, with units 9 and 11 excavated through seven levels, while units 10 and 12 were excavated through eight levels. Units 13 to 16, located west of the central 2 X 2, were excavated through seven levels.

The ring is roughly oval in outline (Balcom 1987:130, Figure: Ring 4g) with an average inside diametre of 4.25 metres and outside diametre of 5.13 metres. Balcom (1987:58) originally described the ring as being composed of 26 rocks, although excavation in 1987 has resulted in changing this total to 33 stones.

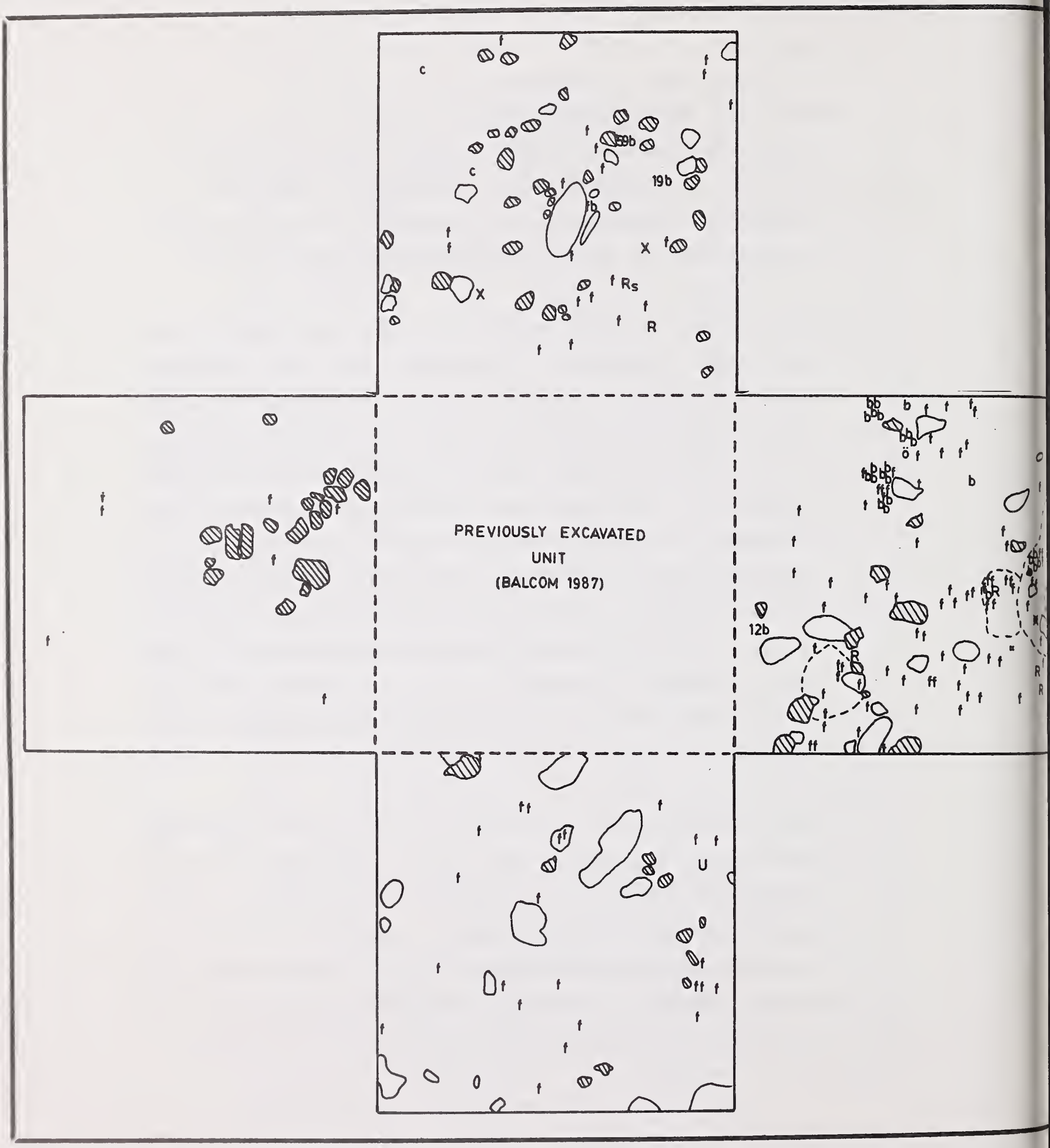


Figure 21 Feature Map, Ring 4g, buried materials

Analysis of the ring in 1987 indicates that the north and south each contain the greatest number of rocks at seven, while the southeast has but one. The north sectors seven rocks have an average weight of 12.50 kilograms (combined weight of 87.50 kgs). The northeast sector contains 2 rocks with an average weight of 7.00 kilograms (combined weight of 14.00kgs). The east contains 5 rocks with an average weight of 10.20 kilograms (combined weight of 51.00 kgs). The southeast sectors' one rock has a weight of 6.5 kilograms. The south has seven rocks with an average weight of 7.64 kilograms (combined weight of 53.50 kgs). The southwest contains 4 rocks, but three of these rocks were removed during 1986 backfilling. The one remaining rock weighs 8 kilograms. The five rocks in the west sector have an average weight of 10.70 kilograms (combined weight of 53.50 kgs). The northwest sector has two rocks with an average weight of 6.50 kilograms (combined weight of 13.00 kgs). Although both the north and south each contain seven rocks, the north rocks are heavier and this is the most heavily weighted sector. The most lightly weighted sector is the northwest sector, followed closely by the northeast. Once again, these data supply little support for Brumley and Dau's hypothesis.

The depths of the ring rocks range from a minimum of 10 (n=6) to a maximum of 17 (n=2), with a mean depth of 12.82 and modal depth of 10 centimetres below surface. This suggests that the ring living floor was located in level three. Analysis of Table 3, however, indicates increasing density of cultural material with depth until level six (25 to 30 cms BS), much below the suggested ring living floor, is reached. This is strongly indicative of the presence of two or more components. Balcom (1987:65) also suggests the presence of a buried component.

> "Another probable buried ring was exposed in Ring 4g. While the floor of the ring which was exposed on the surface was approximately 18 cm below surface, the rock clusters of the buried ring are about 25 cm below surface. ... the greatest number of artifacts came from the levels containing the buried rocks and below rather than the one containing the surface ring. While there are 15 artifacts in the first three levels which extend to 17 cm below surface, there are 31 in the lower three which extend to 35 cm."

Analysis of cultural material provenience data indicates two concentrations, the upper one between approximately 11 and 17 centimetres below surface, and the lower concentration between approximately 23 and 32 centimetres below surface. Significantly, the Besant point recovered by Balcom came from 12 to 17 centimetres below surface, the same depth as the concentration noted for the 1987 material.

In addition, this depth coincides with the ring rock depth. Unfortunately no culturally diagnostic material was recovered from the lower pre-Besant component.

All material recovered during the course of the 1987 excavations is summarized in Table 3. Even though the ring level is between 11 and 17 centimetres below surface, material recovered from levels one through four is believed to be associated with the ring, while levels five through eight are associated with the buried component. The small amount of material present in levels one and two and lower half of level four likely reflects post-depositional movement of ring material, while the material recovered from the upper half of level five, lower half of level seven and the two items from level eight likely reflect post-depositional movement of the buried component material. Although the majority of material within level four is believed to come from the ring, the relatively high amount of material present in this level in comparison to level three may reflect some upward movement of underlying material.

In total, 130 (8.12 items / sq m) cultural items were recovered from the ring levels. Of this total 8 (0.50 items / sq m; 6.15%) items came from level one, 5 (0.31 items / sq m; 3.85%) from level two, 43 (2.69 items / sq m;

33.08%) from level three, and 74 (4.62 items / sq m; 56.9%) from level four.

The distribution of lithic artifacts by artifact type *versus* raw material for the ring levels is summarized in Table 20. A total of 84 (5.25 items / sq m) lithic artifacts were recovered from the ring levels. Level one yielded 7 (0.44 items / sq m; 8.33%) lithic artifacts, level two 4 (0.25 items / sq m; 4.76%) artifacts, level three 29 (1.81 items / sq m; 34.52%) artifacts, and level four yielded the greatest quantity of lithic artifacts at 44 (2.75 items / sq m; 52.38%).

Lithic raw materials recovered from the ring levels include quartzite (n=53; 63.10%), assorted cherts (n=16; 19.05%), chalcedony (n=5; 5.95%), brown chalcedony (n=3; 3.57%), silicified siltstone (n=3; 3.57%), and 1 (1.19%) item each of pebble chert, Avon chert, Montana chert, and ignimbrite.

The faunal assemblage recovered from the ring levels consists of 24 unburnt unidentifiable bone fragments and 1 unidentifiable tooth fragment (N=25; 1.56 items / sq m). Twelve (0.75 items / sq m; 48.00%) of the bone fragments came from level three, while the remaining 12 bone fragments and the 1 tooth fragment (n=13; 0.81 items / sq m; 52.00%) came

Ring 4g: Levels 1 - 4	QTZITE	S.A.	Ind.	Pebble	CHERT Etherington	Swan River	Montana	Avon	KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	1		1																			2
Scrapers (End/Side)								1														1
Retouched Flakes	2						1															3
Utilized Flakes	1										2											3
Cores/Core Frags.	2		1																			3
Decortication Flakes																						
Primary	7		3							1												11
Secondary	2		4																			6
Waste Flakes																						
Shatter	5									1												6
Block Fracture																						
Secondary Flakes	29		3							3	1	2							1			39
Thinning	2																					2
Resharpening																						
Retouch	2		3									1										6
Edge Preparation			1																			1
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles				1																		1
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	53		16	1			1	1		5	3	3							1			84

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

Table 20 Frequency of Artifacts Recovered by Material, Ring 4g (ring level)

from level four. Levels one and two did not contain any faunal remains.

A total of 21 (1.31 items / sq m) pieces of firebroken rock with a combined weight of 6638 grams were recovered from the ring levels of ring 4g. Only 1 (0.06 items / sq m; 4.76%) small piece of firebroken rock with a weight of 20 grams (0.30%) was obtained from level one. One (0.06 items / sq m; 4.76%) item weighing 817 grams (12.31%) was also recovered from level two. Level three produced 2 (0.12 items / sq m; 9.52%) pieces of firebroken rock with a combined weight of 2423 grams (36.50%). The majority of the firebroken rock was recovered from level four which produced 17 (1.06 items / sq m; 80.95%) pieces with a combined weight of 3378 grams (50.89%).

The vast majority of the cultural material recovered from excavation of ring 4g, 86.37% (n=824; 51.5 items / sq m), was recovered from the buried pre-Besant component. Of this total, 239 (14.93 items / sq m; 29.00%) items came from level five, 414 (25.88 items / sq m; 50.24%) came from level six, 169 (14.08 items / sq m; 20.51%) from level seven, while level eight produced 2 (1.00 items / sq m; 0.24%) pieces of cultural material.

The distribution of lithic artifacts by artifact type *versus* material type for the

	QTZITE	S.A.	Ind.	Pebble	CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 4g: Levels 5 - 8					Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	1																					1
Scrapers (End/Side)			1																			1
Retouched Flakes	2							1				1	2									6
Utilized Flakes												1										1
Cores/Core Frags.	3		1																			4
Decortication Flakes																						
Primary	35		10																			45
Secondary	39		7											1								47
Waste Flakes																						
Shatter	45		10									2		1								58
Block Fracture	4		1																			5
Secondary Flakes	156		40							2		2										200
Thinning	1		3								1											5
Resharpening																						
Retouch	47		31							2		3		1								84
Edge Preparation	2																					2
Core Rejuvenation	2																					2
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles	2			1																1		4
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																					2	2
Total	339		104	1				1		4	1	9	2	3						1	2	467

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 21 Frequency of Artifacts Recovered by Material, Ring 4g (buried horizon)

buried component is summarized in Table 21. In total, 467 (29.19 items / sq m) lithic artifacts were recovered from the buried component. Level five produced 164 (10.25 items / sq m; 35.12%) lithic artifacts, level six yielded 236 (14.75 items / sq m; 50.54%) items, while 67 (5.58 items / sq m; 14.35%) pieces were recovered from level seven. No lithic artifacts were recovered from level eight.

Lithic raw materials recovered from the buried component consist of quartzite (n=339; 72.59%), assorted cherts (n=104; 22.27%), silicified siltstone (n=9; 1.93%), quartz (n=3; 0.64%), 2 (0.43%) items each of petrified wood and ochre, plus 1 (0.21%) piece each of pebble chert, brown chalcedony, Avon chert, and schist.

Faunal material recovered from the lower component consists of 268 (16.75 items / sq m) pieces of unburnt unidentifiable bone fragments. However, miniscule burnt bone fragments were noted for the lower component, but their small size prohibited recovery. Twenty (1.25 items / sq m; 7.46%) of the recovered fragments came from level five, 146 (9.12 items / sq m; 54.48%) from level six, 100 (8.33 items / sq m; 37.31%) from level seven, and only 2 (1.00 items / sq m; 0.75%) from level eight.

Eighty nine (5.56 items / sq m) pieces of firebroken rock with a combined weight of 38254 grams were recovered from the lower component. The majority of these (n=55; 3.44 items / sq m; 61.80%), with a combined weight of 30481 grams (79.68%), were recovered from level five. Level six yielded 32 (2.00 items / sq m; 35.96%) pieces with a combined weight of 6946 grams (18.16%), while level seven produced 2 (0.17 items / sq m; 2.25%) pieces of firebroken rock with a combined weight of 827 grams (2.16%). No firebroken rock was recovered from level eight.

Attempting to define cultural patterning for the ring levels is not possible as Balcom (1987) did no provide provenience data for the crucial centre unit. There is also a problem with the lower component as the units are not contiguous (Figure 21). The type of cultural material recovered from the lower component, and its distribution (Figure 21), is indicative of a meat and bone processing activity area. The combination of tiny burnt bone fragments and staining of the soil in the eastern units indicates that meat was also being cooked, although no defined hearths were recovered. Unlike the McKean activity area, it does not appear that this area was used for more than one function. Lithics recovered from the activity area consist of artifacts affiliated with meat processing -- flakes, retouched flakes, utilized flakes, a chopping tool, a scraper, four core fragments, and four split cobbles. The quantity and distribution of firebroken rock and bone supports this task specific activity. In general, the data indicate that the area was intensively used for the processing and preparation of food, and does not indicate the presence of a buried ring as hypothesized by Balcom. The fact that the data do indicate food preparation may also indicate that this was an exclusively female activity area. Unfortunately, as no diagnostic artifacts were recovered, no cultural identity can be provided for the activity area. However, the presence of a Besant point in the overlying ring indicates that the activity area is pre-Besant in age.

Comparison and Discussion

The Besant occupation of the central area of the Cranford Site is composed of two stone circles: 4g and 4f. The total Besant cultural material assemblage, not including an unknown quantity of material recovered during 1986, consists of 313 (8.69 items / sq m) items recovered from 36 square metres of excavation. The assemblage is comprised of 181 (5.03 items / sq m) lithic artifacts, 55 (1.53 items / sq m) faunal remains, and 77 (2.14 items / sq m) pieces of firebroken rock with a combined weight of 11672.5 grams.

The size of the two rings varies somewhat with ring 4f measuring 3.90 metres in average diametre, and ring 4g measuring 4.69 metres. This difference in size, approximately 17%, may reflect either social or behaviourial significance, or, alternatively, the number of individuals living in the tipi.

Both rings are most heavily weighted in the north sector, while ring 4f is lightest in the northeast sector and ring 4g in the northwest. However, ring 4g's northeast sector is only 1 kilogram heavier than the northwest (14.00 kgs *versus* 13.00 kgs). The fact that for both rings the most heavily weighted sector is immediately adjacent to the least heavily weighted sector argues against a correlation between weighting and wind. Therefore, I believe the fact that both rings are most heavily weighted in the north is merely a coincidence, or that some factor other than wind is in effect. Whether or not there is some behaviourial or social significance to such a rock distribution can not be ascertained from a sample of two rings.

The density of cultural material within each ring is also quite similar at 9.15 items / sq m for 4f and 8.12 items / sq m for 4g. The classes of material comprising the assemblage are also quite similar. The density of lithic artifacts for ring 4g is 5.25 items / sq m compared to 4f at 4.85 items / sq m. If the 15 lithic artifacts recovered from the central 2m X 2m unit excavated by Balcom (1987) are incorporated into the assemblage, the density of lithic artifacts recovered from the ring 4g drops from 5.25 to 4.95 items / sq m resulting in a difference of 0.10 items / sq m between the two rings. The faunal assemblage density for 4f is 1.50 items / sq m while 4g's density is 1.56 items / sq m. Balcom (1987:64) recovered 33 unidentifiable bone fragments from 4g, but vertical provenience data allowing for separation of this material into ring and buried components is not available. Although a greater quantity of firebroken rock was recovered from 4f (2.80 items / sq m compared to 1.31 items / sq m), ring 4g had a greater weight of firebroken rock at 414.88 grams / sq m *versus* 251.72 grams / sq m for 4f. Balcom (1987) also recovered one small piece of firebroken rock from the central unit of ring 4g thereby lowering the density of firebroken rock recovered from 4g to 1.10 items / sq m. Although Balcom (1987) does not provide a weight for this piece of firebroken rock, the fact that it is described as "small" likely indicates that a concomitant decrease in grams of firebroken rock / sq m for ring 4g would also be expected. In general, available data suggests that the ring 4g and ring 4f assemblages are similar in terms of the density of material recovered.

On the other hand, the lithic assemblages themselves do display some differences. A total of 4 points were recovered from 4f, but only 1 from 4g. In addition, ring 4g displays more secondary flakes than 4f, while ring 4f contained more thinning flakes than 4g. This combination of factors indicates a difference in the type of activities being conducted within each ring. Specifically an emphasis on the final preparation of tools in ring 4f (higher incidence of tertiary flakes, particularly thinning flakes *versus* decortication flakes, secondary flakes and cores & core fragments) and reduction of material in ring 4g (higher incidence of secondary flakes, decortication flakes, and cores & core fragments versus tertiary flakes). Unfortunately, the 15 artifacts recovered from ring 4g by Balcom were not subdivided into the same artifact classes used for the material recovered in 1987. Therefore, what affect these artifacts may have on the interpretation supplied here is unknown.

The raw material assemblages for each ring do show some differences. The distribution of raw material types for ring 4f is far more homogeneous than for 4g. Although both contain more quartzite than any other material type, likely a product of local availability, ring 4f contains only 22.68% quartzite *versus* ring 4g at 63.10% quartzite. In addition, the lithic assemblage from 4f contains 20.61% Knife River Flint and 11.34% brown chalcedony (these two types of material are presented together due to difficulties in separating the one from the other at a macroscopic level) while 4g contained no Knife River Flint and only 3.57% brown chalcedony. These differences, however, are entirely consistent with the types of artifacts recovered. Knife River Flint, for example, is an imported or non-local material and is, therefore, more highly curated. As a result, one would not expect to find many secondary flakes, but rather a combination of tools and tertiary flakes. This is, indeed, the case for ring 4f. On the other hand, quartzite, being locally available, is not curated. Therefore, a high incidence of secondary flakes is expected and realized for ring 4g.

One final topic for consideration concerns the spatial relationship between the two Besant rings. As can be seen from the site map (Figure 9), the two rings are located approximately 70 metres apart. This factor, combined with the lithic assemblage differences, leads me to two discrete postulations. First, that the rings are not contemporaneous, or secondly, if they are contemporaneous, that the occupants of each ring are socially separate. It could be argued that the fact that 4g contained little in the way of exotic material indicates a relatively low social status, and the difference in social status caused the spatial separation of the two rings. However, a more simple explanation is that the two rings represent two discrete occupations and this is why they are spatially separated and contain different lithic assemblages.

6.5 Avonlea (circa 1750 - 1150 BP)

The Avonlea phase is represented by only one ring: 4i. A single Avonlea point was recovered from level three of this ring.

i) Ring 4i

Ring 4i was excavated with a central 2m X 2m unit by Balcom (1987) in 1986. An additional four square metres were excavated at this ring in 1987 due to the high yield in artifacts and bone obtained by Balcom. Basal gravel was reached in all four units at 20 centimetres below surface.

The ring is roughly oval in shape, with the long axis oriented northeast to southwest (Balcom 1987:131, Figure: Ring 4i Plan). It possesses a mean inside diametre of 3.80 metres and outside diametre of 4.69 metres (Balcom 1987:58, Table 9). Analysis undertaken in 1987 indicated the ring to be composed of 23 rocks. All but two of these rocks were weighed and basal depth below surface recorded. This was not possible for two rocks located in the northeast as they were removed during 1986 backfilling operations. The rocks are fairly evenly distributed around the ring, with the greatest quantity of rock being in the east, although this distribution may be biased as excavation of the eastern units resulted in the documentation of an additional three rocks not diagrammed by Balcom (1987:131). The north sector contained 3 rocks with an average weight of 8.33 kilograms (combined weight of 25.00 kgs). The northeast sector contained three rocks, but only one of these could be measured.

This rock weighed 13.50 kilograms. The eastern sector contained the greatest number of rocks at 5 with an average weight of 7.33 kilograms (combined weight of 36.50 kgs). The southeast contained 2 rocks with an average weight of 6.00 kilograms (combined weight of 12.00 kgs). The south sector also contained 2 rocks with an average weight of 9.50 kilograms (combined weight of 19.00 kgs). The southwest sector contained 3 rocks with an average weight of 5.67 kilograms (combined weight of 17.00 kgs). The west sector contained 3 rocks with an average weight of 12.67 kilograms (combined weight of 38.00 kgs). The northwest sector contained 2 rocks with an average weight of 21.50 kilograms (combined weight of 43.00 kgs). This distribution indicates that although the eastern sector contained the greatest number of rocks, the northwest contained the greatest amount of rock by weight, with the western sector following second. By weight, the east finished third. Once again, the data recovered from the Central area of the Cranford site fail to support the wind / rock weight model postulated by Brumley and Dau (1988). However, it should be kept in mind that the data presented here are biased due to a lack of data concerning buried ring rocks for all sectors except the east, combined with missing data for two of the three ring rocks located in the northeast sector. This latter point could be especially significant as this sector falls along the long axis of the ring.

The depths of the ring rocks range from a minimum of 8 (n=3) centimetres below surface to a maximum of 22 (n=2) centimetres below surface. The mean depth is 12.90 and the modal depth 9 centimetres below surface; this variation being the result of wide ranging depths. Provenience data indicates the living floor at 13 to 14 centimetres below surface, a value that correlates well with the mean depth below surface for the ring rocks.

All material recovered in 1987 from ring 4i is summarized in Table 3. The distribution of material indicates that all levels are likely associated with the ring. A total of 70 (17.5 items / sq m) cultural items were obtained from the ring. This total is comprised of 4 (1.0 items / sq m; 5.71%) items from level one, 7 (1.75 items / sq m; 10.00%) from level two, 58 (14.5 items / sq m; 82.86%) from level three, and only 1 (0.25 items / sq m; 1.43%) item from level four.

The distribution of lithic artifacts by artifact type *versus* raw material is summarized in Table 22. In total, 51 lithic artifacts were recovered from ring 4i, 6 (1.5 items / sq m; 11.76%) from level two, 44 (11.00 items / sq m; 86.27%) from level three, and 1 (0.25 items

	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 41: All Levels			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]			1																			1
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces	1																					1
Chopping Tools	2																					2
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	3																					3
Secondary	6											1										7
Waste Flakes																						
Shatter	6													4								10
Block Fracture																						
Secondary Flakes	18													3								21
Thinning	6																					6
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	42		1									1		7								51

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 22 Frequency of Artifacts Recovered by Material, Ring 4i

/ sq m; 1.96%) from level four. No lithic artifacts were acquired from level one.

Raw material types recovered during the course of excavating ring 4i are comprised of only four different material types. Quartzite (n=42; 82.35%) makes up the vast majority of the raw material, followed by quartz (n=7; 13.72%), and chert and silicified siltstone with one artifact each (1.96% each). The one chert artifact was the Avonlea point. This distribution of material types is consistent with Avonlea's emphasis on local raw material (see Vickers 1986:94).

The faunal assemblage consists of only 2 (0.5 items / sq m) unidentifiable bone fragments recovered from level three.

The firebroken rock collection consists of 17 (4.25 items / sq m) pieces with a combined weight of 3130 grams. Four (1.00 items / sq m; 23.53%) pieces of firebroken rock with a combined weight of 1000 grams (31.95%) were obtained from level one, 1 (0.25 items / sq m; 5.88%) with a weight of 500 grams (15.97%) from level two, and 12 (3.00 items / sq m; 70.59%) pieces with a total weight of 1630 grams (52.08%) from level three. No firebroken rock was recovered from level four.

Unfortunately, a lack of provenience data from the central 2m X 2m unit makes a discussion of cultural patterning for this ring impossible. The material from the east unit yields little in the way of patterning, other than demarcating the living floor depth.

6.6 Old Women's (600 AD - 1700 AD)

The Old Women's phase of the Central area of the Cranford Site is represented by two rings. Ring 4h has been ascribed to the Old Women's phase on the basis of the recovery of a point classified as Prairie Side Notched (Kehoe 1966, 1973). Ring 32e has also been ascribed to the Old Women's phase on the basis of the recovery of a point classified as Plains Side Notched (Kehoe 1966, 1973). Given the variation in the points, it is likely that these two rings represent discrete occupations. This supposition is supported by the fact that the rings are located a considerable distance apart (Figure 9).

i) Ring 4h

Ring 4h, excavated with four square metres in the form of one centrally located 2m X 2m unit, is roughly circular in outline, although the eastern half of the ring appears to be somewhat disturbed. All four units were excavated to basal gravel at a depth of 15 centimetres below surface.

The ring has an average inside diametre of 4.78 and outside diametre of 5.65 metres (Table 23); disturbance in the eastern half of the ring has influenced these measurements. The ring is made from 71 rocks, although one of the rocks located in the northeast -- rock 15 (completely buried, Figure 22) -- is not likely a ring rock, but a naturally occurring cobble (Table 23). Of the seventy remaining rocks, 7, with an average weight of 12.36 kilograms (combined weight of 86.50 kgs), are located in the northern sector. The northeast sector contains 9 rocks, not including rock 15, with an average weight of 9.89 kilograms (combined weight of 89.00 kgs). The east sector contains 5 rocks with an average weight of 17.10 kilograms (combined weight of 85.50 kgs). The southeast sector contains the greatest number of rocks at 16 with an average weight of 5.91 kilograms (combined weight of 94.50 kgs). The south contains 9 rocks with an average weight of 8.78 kilograms (combined weight of 79.00 kgs). The 12 rocks from the southwest have an average weight of 6.67 kilograms (combined weight of 80.00 kgs). The western sector contains the least number of rocks at 4 with an average weight of 12.38 kilograms (combined weight of 49.50 kgs). The northwest has 8 rocks with an average weight of 13.25 kilograms (combined weight of 106.00 kgs). In terms of weight, the northwest contains the greatest

RING 4h

		Inside	Outside	Average
Diametres:	North South	5.35m	6.15m	5.75m
	Northeast - Southwest	4.50m	5.40m	4.95m
	East-West	4.75m	5.60m	5.18m
	Southeast-Northwest	4.50m	5.45m	4.98m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	18	16	S	39	3	12
	2	3.5	14		40	7.5	12
	3	5	13		41	2	11
	4	9	15		42	12.5	14
	5	19	14		43	7	14
	6	10.5	16		44	18	16
	7	21.5	19		45	8	14
NE	8	24	14		46	8	13
	9	16.5	16		47	13	17
	10	4	10	SW	48	5.5	14
	11	5	13		49	7.5	14
	12	3	8		50	8	13
	13	8	14		51	10	15
	14	4.5	12		52	10.5	14
NRR	15	100	30		53	7.5	11
	16	11	14		54	2	12
	17	13	18		55	4.5	11
E	18	12	18		56	1.5	10
	19	25	22		57	7	12
	20	17	19		58	10	10
	21	12.5	18		59	6	12
	22	19	15	W	60	14	16
SE	23	3	11		61	17	16
	24	5	15		62	17.5	18
	25	7	13		63	1	8
	26	5	11	NW	64	25	23
	27	5.5	16		65	12.5	18
	28	8	8		66	20	18
	29	2	7		67	17	16
	30	11.5	16		68	8.5	14
	31	4	11		69	3	15
	32	3.5	13		70	7	13
	33	4.5	13		71	13	13
	34	10.5	15				
	35	5	14				
	36	7	16				
	37	7	13				
	38	6	10				

Table 23 Basic Ring Data, Ring 4h

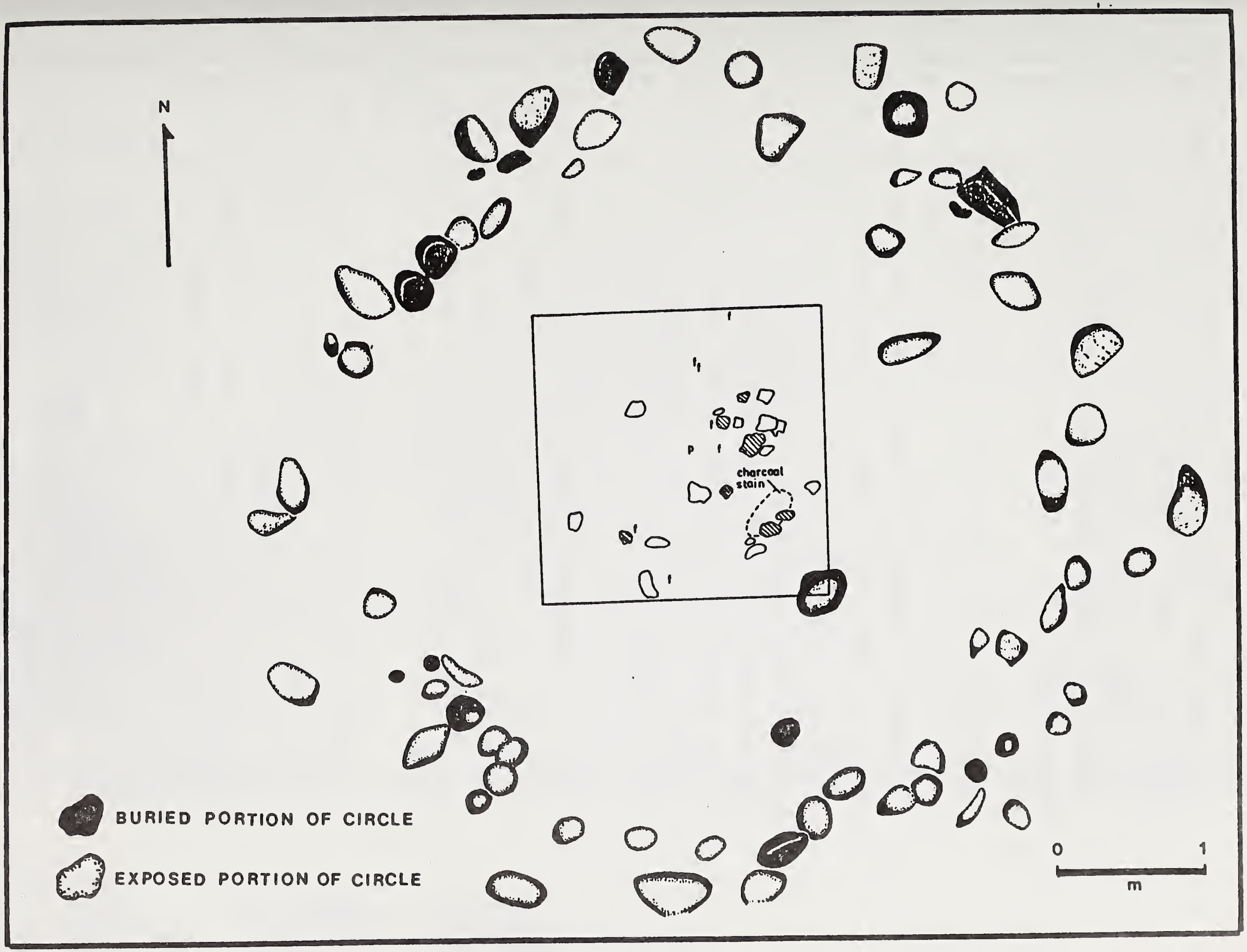

Figure 22 Feature Map, Ring 4h

quantity of rock, and the west the least quantity. This, combined with the fact that the longest axis is north to south, does not support the hypothesis suggested by Brumley and Dau (1988).

The depths of the ring rocks range from a minimum of 7 (n=1) to a maximum of 23 (n=1) centimetres below surface while the mean depth is 13.98 and modal depth 13 centimetres below surface. Combining these values with artifact proveniences indicates a living floor depth of approximately 10 centimetres below surface. As all material recovered from this ring was acquired in levels two and three, it is all likely associated with ring occupation.

Material recovered from ring 4h is summarized in Table 3. Of the 56 (14.00 items / sq m) cultural items recovered, 28 (7.00 items / sq m; 50.00%) came from each of levels two and three.

A summary of lithic artifacts by artifact type *versus* raw material is presented in Table 24. Of the 17 (4.25 items / sq m) artifacts recovered, 9 (2.25 items / sq m; 52.94%) were from level two, and 8 (2.00 items / sq m; 47.06%) from level three. Raw material types recovered consist of quartzite (n=8; 47.06%), chert (n=3; 17.65%), Knife River Flint (n=3; 17.65%), a brown chalcedony which may also be

Ring 4h: All Levels	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]									1													1
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	1																					1
Secondary	1								1													2
Waste Flakes																						
Shatter			1																			1
Block Fracture																						
Secondary Flakes	5		1						1													7
Thinning	1		1								2			1								5
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	8		3						3		2			1								17

---

[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 24 Frequency of Artifacts Recovered by Material, Ring 4h

Knife River Flint (n=2; 11.76%), and 1 (5.88%) piece of petrified wood.

The faunal assemblage consists of a total of 13 (3.25 items / sq m) unidentifiable bone fragments. Only 1 (0.25 items / sq m; 7.69%) bone fragment was derived from level two, while the remaining 12 (3.00 items / sq m; 92.31%) fragments came from level three.

Of the 26 (6.50 items / sq m) pieces of firebroken rock with a combined weight of 6634 grams recovered from ring 4h, 18 (4.50 items / sq m; 69.23%) with a combined weight of 5334 grams (80.40%) were acquired from level two, and 8 (2.00 items / sq m; 30.77%) with a combined weight of 1300 grams (19.60%) from level three.

As can be seen from Figure 22, no distinctive patterning is apparent in the cultural material recovered *in situ*. However, the charcoal stain and the scattered firebroken rock likely indicates the presence of a central hearth. Perhaps the disturbance seen in the eastern ring rocks is repeated with the excavated material resulting in the scattering of firebroken rock apparent in Figure 22.

ii) Ring 32e

Ring 32e has been ascribed to the Old Women's Phase on the basis of the recovery of a small side notched point morphologically similar to Plains Side Notched points (Kehoe 1966, 1973). The ring, roughly 'egg-shaped' in outline (Figure 23), was excavated with a total of 8 square metres. Units 1 & 2 were excavated through four levels (20 cms BS), while units 3 to 8 were excavated through six levels (30 cms BS). All units were excavated to basal gravel.

The ring is composed of 54 stones and has an average inside diametre of 4.35 metres, and outside diametre of 4.92 metres (Table 25). The north sector contains 5 rocks with an average weight of 11.40 kilograms (combined weight of 57.00 kgs). The northeast sector contains 5 rocks with an average weight of 9.10 kilograms (combined weight of 45.50 kgs). The east sector contains the fewest rocks at 4 but they possess an average weight of 22.62 kilograms (combined weight of 90.50 kgs). The southeast sector contains 8 rocks with an average weight of 8.94 kilograms (combined weight of 71.50 kgs). The south sector contains 7 rocks with an average weight of 8.14 kilograms (combined weight of 57.00 kgs). The southwest sector contains the greatest number of rocks at 12 with an average weight of 11.58 kilograms (combined weight of 139.00 kgs). The

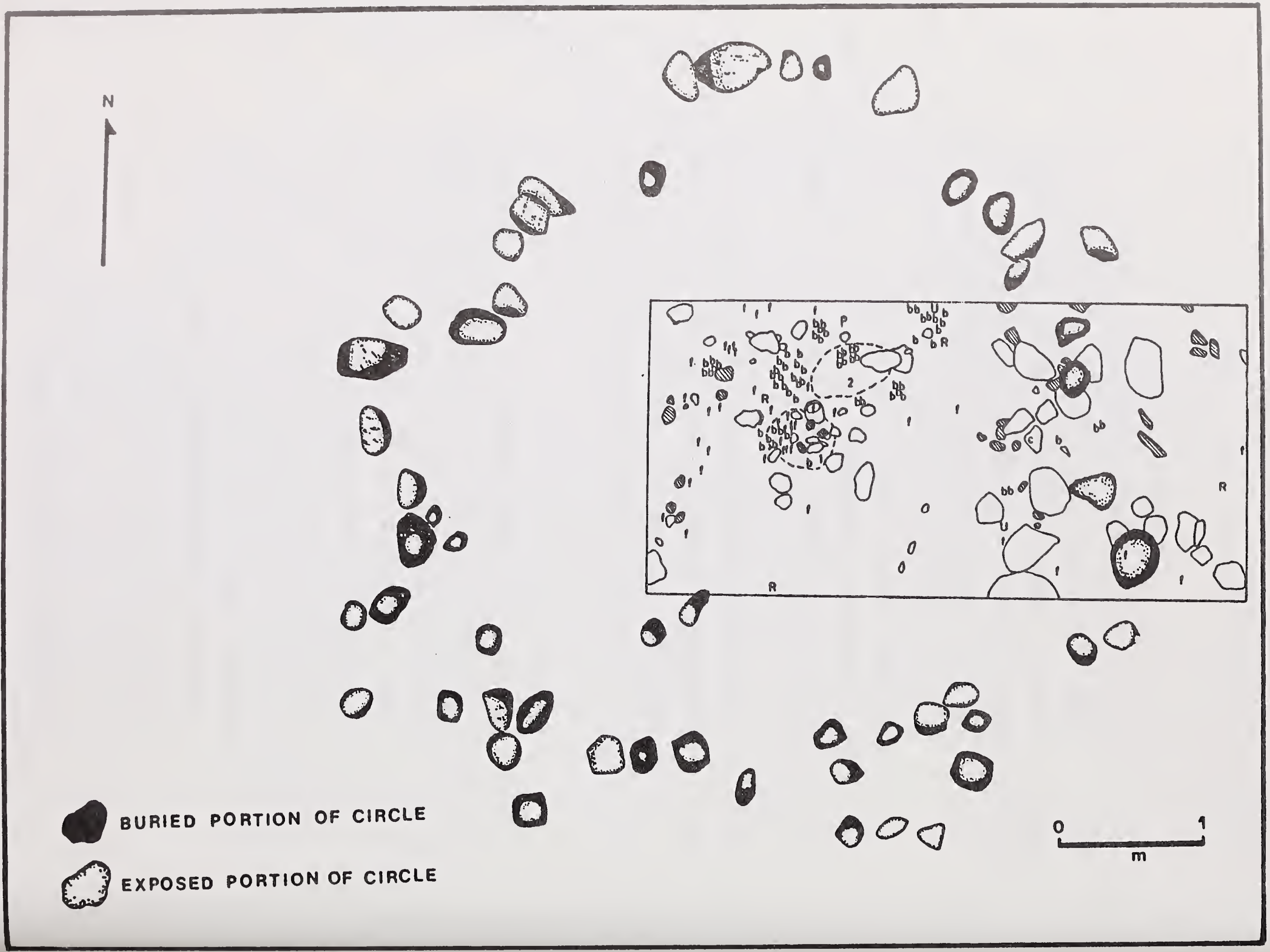

Figure 23 Feature Map, Ring 32e

RING 32e

		Inside	Outside	Average
Diametres:	North South	4.38m	4.80m	4.59m
	Northeast - Southwest	4.20m	4.90m	4.55m
	East-West	4.50m	5.00m	4.75m
	Southeast-Northwest	4.32m	5.00m	4.66m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)
N	1	5	11
	2	33	14
	3	7	10
	4	8	10
	5	4	7
NE	6	12	14
	7	13	15
	8	9	15
	9	4.5	12
	10	7	20
E	11	8	15
	12	10.5	14
	13	36	20
	14	36	16
SE	15	6	9
	16	9.5	14
	17	14.5	17
	18	4	14
	19	7	10
	20	18	18
	21	5.5	11
	22	7	16
S	23	7	12
	24	6	13
	25	7	16
	26	11	15
	27	6	15
	28	12	15
	29	8	13
SW	30	11	12
	31	11	15
	32	11	17
	33	21	18
	34	10	15
	35	7.5	12
SW	36	18	18
	37	6	11
	38	9	13
	39	8.5	11
	40	13	13
	41	13	14
W	42	9	11
	43	7.5	12
	44	5	13
	45	9.5	16
	46	11	15
	47	12	14
	48	10	14
NW	49	15	14
	50	11	14
	51	5	12
	52	17.5	18
	53	12	14
	54	7	12

Table 25 Basic Ring Data, Ring 32e

west sector contains 7 rocks with an average weight of 9.14 kilograms (combined weight of 64.00 kgs). The northwest sector contains 6 rocks with an average weight of 11.25 kilograms (combined weight of 67.50 kgs). Overall, the southwest contains the greatest weight of rock at 139.00 kilograms, while the northeast sector contains the least amount of rock at 45.50 kilograms. This ring provides some support for the wind hypothesis suggested by Brumley and Dau (1987) as the heaviest and lightest weighted sectors are opposed, but support is not complete as the longest axis is east to west while the northeast to southwest axis is shortest in length, although the difference between longest and shortest axes is only 0.2 metres.

The depths of the ring rocks ranges from a minimum of 7 (n=1) to a maximum of 20 (n=2) centimetres below surface, with a mean depth of 13.87 and modal depth of 14 centimetres below surface. Combining this data with cultural material provenience data indicates a living floor depth of 9 to 14 centimetres below surface, although material from all six levels is believed to be associated with the ring. A very slight concentration of material underneath the ring rocks and at a depth between approximately 22 and 27 centimetres below surface may be indicative of a buried component, but I believe it more likely represents downward movement of ring material, possibly as a result of either intentional discard or natural movement, or a combination of both. It may also have become displaced during removal of the tipi itself.

All cultural material recovered is summarized in Table 3. A total of 412 (51.50 items / sq m) cultural items were recovered from the ring, making this the fifth most productive ring in the Central area. Of this total, 1 (0.12 items / sq m; 0.24%) item came from level one, 118 (14.75 items / sq m; 28.64%) from level two, 136 (17.00 items / sq m; 33.01%) from level three, 134 (16.75 items / sq m; 32.52%) from level four, 20 (3.33 items / sq m; 4.85%) from level five, and 3 (0.50 items / sq m; 0.73%) items came from level six.

The distribution of lithic artifacts by artifact type *versus* raw material type is summarized in Table 26. A total of 184 (23.00 items / sq m) lithic artifacts were recovered from ring 32e. Only 1 (0.12 items / sq m; 0.54%) artifact was recovered from level one, while 62 (7.75 items / sq m; 33.70%) came from level two, 60 (7.50 items / sq m; 32.61%) from level three, 49 (6.12 items / sq m; 26.63%) from level four, 10 (1.67 items / sq m; 5.43%) from level five, and 2 (0.33 items / sq m; 1.09%) artifacts from level six.

Ring 32e: All Levels	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]											1											1
Bifaces									1													1
Piece Esquilles/Wedges										1												1
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes	1		3						1	1	3											9
Utilized Flakes				1			1				1		1									4
Cores/Core Frags.	2																					2
Decortication Flakes																						
Primary	8		1								1			5								15
Secondary	3		2							1				2								8
Waste Flakes																						
Shatter	5		2											1								8
Block Fracture	1																					1
Secondary Flakes	43		6							1	4		1	12								67
Thinning	4		19				1			10	14		2			1						51
Resharpening																						
Retouch	1		4							1	9											15
Edge Preparation																						
Core Rejuvenation	1																					1
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	69		37	1			2		2	15	33		4	20		1						184

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

Table 26 Frequency of Artifacts Recovered by Material, Ring 32e

Lithic raw material types recovered include quartzite (n=69; 37.50%), assorted cherts (n=37; 20.11%), a brown chalcedony very similar to Knife River Flint but lacking inclusions (n=32; 17.39%), quartz (n=20; 10.87%), chalcedony (n=15; 8.15%), petrified wood (n=4; 2.17%), Montana chert (n=3; 1.63%), Knife River Flint (n=2; 1.09%), and 1 (0.54%) each of pebble chert and obsidian. Within the assemblage quartzite increases with depth, while the brown chalcedony decreases with depth. The exact significance of this is unknown. As mentioned, it is possible that there is a buried component, however the distribution of raw material types does not substantiate this possibility. If the increasing percentage of quartzite and decreasing percentage of brown chalcedony were linked to this possible buried component, then I would expect the actual amount of quartzite to increase and reach a maximum amount in the buried component. This is not the case. Although the percentage of quartzite relative to other material types increases, the actual amount of quartzite peeks in level four, and then drops substantially (from 31 to 7 items) in level five. This does not support the concept of a buried component being responsible for increasing quantities of quartzite with depth, unless that buried component lies in level four. This does not appear to be the case as the patterning apparent in Figure 23 is derived from all artifacts recovered *in situ*. If level four was a separate occupation, then I would think it would display patterning inconsistent with other levels. Such a discrepancy is not manifested in Figure 23. Therefore, I conclude that variations in frequency between quartzite and brown chalcedony stem from coincidence rather than culture (***N***-transforms *versus* **C**-transforms).

The faunal assemblage of ring 32e consists of 142 unburnt unidentifiable bone fragments, 7 burnt unidentifiable bone fragments, and 2 *Bison bison* medial phalanges (N=151; 18.88 items / sq m). Of these, level two contained 21 unburnt bone fragments and 1 bison phalange (n=22; 2.75 items / sq m; 14.57%), level three contained 66 unburnt fragments (8.25 items / sq m; 43.71%), and level four possessed 55 unburnt fragments, 7 burnt bone fragments, and a bison medial phalange (n=63; 7.88 items / sq m; 41.72%).

Seventy seven (9.62 items / sq m) pieces of firebroken rock with a combined weight of 15712.5 grams were also recovered from ring 32e. Level two yielded 34 (4.25 items / sq m; 44.16%) pieces of firebroken rock for a total of 4681.5 grams (29.79%), level three produced 10 (1.25 items / sq m; 12.99%) pieces for a combined weight of 3889 grams (24.75%), level four contained 22 (2.75 items / sq m; 28.57%)

pieces weighing 5359 grams (34.11%), level five provided 10 (1.67 items / sq m; 12.99%) pieces with a combined weight of 1683 grams (10.71%), while only 1 (0.17 items / sq m; 1.30%) weighing 100 grams (0.64%) was recovered from level six.

As can be seen from Figure 23, the interior of the ring was heavily utilized. As only the central and eastern areas of the ring were excavated, any interpretation of activities conducted within the ring must be limited to these areas. The presence of firebroken rock, burnt bone, and charcoal indicate that food was being cooked within the confines of the tipi. In addition, the two flake concentrations, combined with the overall pattern apparent in the north central area of the ring suggests that this is the area where meat was being processed. Somewhat surprisingly, it does not appear that any effort was made to clean this area, although the concentration apparent in level four may indicate either intentional or accidental burial of refuse. However, charcoal lenses in the vicinity of the two flake concentrations may indicate that this area served both for cooking of food, as well as a suitable spot for the discarding of waste material; that is, waste material was thrown into the hearth. The concentration of material and the presence of an internal hearth may be indicative of inclement, although not necessarily winter, weather.

Comparison and Discussion

The Old Women's occupation of the central area of the Cranford Site is composed of two stone circles: 4h and 32e. The total Old Women's cultural material assemblage consists of 468 (39.00 items / sq m) items recovered from 12 square metres of excavation. The assemblage consists of 201 (16.75 items / sq m) lithic artifacts, 164 (13.67 items / sq m) faunal remains, and 103 (8.58 items / sq m) pieces of firebroken rock with a combined weight of 22346.5 grams.

Ring 4h is approximately 11% larger than ring 32e, with an average diametre of 5.22 metres compared to 4.64 for ring 32e. As with the Besant occupation, I do not believe this difference in size to be either socially or behaviourally significant, although it may be indicative of differing numbers of occupants.

Rock weighting does differ significantly for the two rings. Ring 4h displays greatest rock weighting in the northwest and least weighting in the west. Ring 32e is most heavily weighted in the southwest and lightest in the northeast. This latter distribution does, as discussed, provide limited support for Brumley and Dau's (1988) rock weighting / wind hypothesis.

The density of cultural material within the two rings is also considerably different. The density of material in ring 4h is 14.00 items / sq m compared to 32e at 51.50 items / sq m. This difference is also reflected in the classes of cultural material as well. Ring 4h contained a density of 4.25 lithic artifacts / sq m while 32e possessed 23.00 lithic artifacts / sq m. The same relationship is seen in the faunal material with 4h at 3.25 items / sq m and 32e at 18.88 items / sq m. Firebroken rock continues this trend with 4h yielding 6.50 pieces / sq m compared to 32e's 9.62 pieces / sq m, although the weight of firebroken rock per square metre of excavation is close with 4h producing 1658.50 grams / sq m and 32e 1964.06 grams / sq m. In other words, while ring 4h may have had fewer pieces of firebroken rock, each one of them weighed more than those recovered from 32e.

The types and amounts of lithic material also varied between the two assemblages, but not as greatly as the density of items. Both assemblages are dominated by quartzite (4h = 47.06%; 32e = 37.50%). Ring 4h contains equal proportions of chert and Knife River Flint at 17.65% of the assemblage, while 32e contains 20.11% chert but only 2.17% Knife River Flint. However, 32e contains more brown chalcedony at 17.39% than 4h does at 11.76%. Nevertheless, 4h contains a greater percentage of Knife River Flint / brown chalcedony than does 32e. This difference marks the major separation between the two in terms of lithic materials. A further difference between the two rings is that 32e contains minor amounts of 5 types of material that were not recovered from 4h, although this may simply be a result of sampling error.

Little can be said about the constituents of the lithic assemblages themselves as only 17 lithic artifacts were recovered from 4h, compared to 184 for 32e. In spite of this, examination of the two assemblages indicates them to be roughly comparable. For example, ring 4h contains 41.18% secondary flakes and 29.41% thinning flakes, these being the two dominate categories for the ring. Ring 32e contains 36.40% secondary flakes and 27.72% thinning flakes, also the two dominant categories of material.

Overall then, the two rings display some similarities and some differences. The ring sizes and lithic assemblages are similar, while 4h contains a greater percentage of Knife River Flint and brown chalcedony, and 32e a considerably greater density of material. These differences are further reflected in the difference between points recovered (Prairie Side Notched for 4h and Plains Side Notched for 32e) as well as the spatial separation between the rings. This suggests two discrete occupations, (possibly under different environmental conditions resulting in increased activity within ring 32e, or alternatively, a greater length of occupation for ring 32e), at two discrete times.

6.7 Culturally Unassigned Occupations

The majority of the stone circles (n=18) excavated within the central area of the Cranford Site could not be culturally placed as no culturally diagnostic artifacts were recovered from them. Therefore, with one exception, they do no warrant the level of description provided for those rings which did contain culturally diagnostic artifacts. More detailed information will be presented for ring 4b due to a) Balcom's (1987) hypothesis of the presence of a buried component, which was the main reason for excavating the ring and, b) the fact that a partial point recovered from the lower levels has already been presented as evidence suggesting either Pelican Lake or Besant affinities, and an attempt was made, therefore, to determine the cultural placement of this point by analysis of the assemblage associated with it. In addition, as this ring was excavated by Balcom as well as myself, the data recovered is not entirely consistent with those rings excavated only during the 1987 field season. As a result, it is easier to present data for this ring separately, than to include it in the unassigned summary presented below.

i) Ring 4b

Ring 4b was test excavated with a centrally located 2m X 2m unit by Balcom (1987) during the 1986 field season. Based upon the results of this excavation, Balcom (1987:65) suggested that a possible buried tipi ring was present circa 25 centimetres below surface. An attempt was made to test this buried ring by locating a 2m X 2m unit south southwest of ring 4b (Figure 9). The quantity of material recovered, including two point fragments, lead to the excavation of another 2m X 2m unit immediately to the east of Balcoms' original excavation.

Ring 4b, excavated with a total of 12 square metres, 4 in 1986 (Balcom 1987) and eight during 1987, is roughly circular in outline (Balcom 1987:128, Figure Ring 4b). All units excavated during 1987 were dug to basal gravel. Units 1 and 2 were excavated through eight levels (40 cms BS), and units 3 to 8 through seven levels (35 cms BS).

The ring is composed of 39 stones and has an average inside diametre of 3.93 metres, and outside diametre of 5.19 metres (Balcom 1987:58, Table 9). Displacement of ring rocks during backfilling conducted during 1986 made attempts at recording ring rock depth and weight difficult. In total, only six rocks, representing a biased 15.38% sample, were weighed and measured for depth below surface. These six rocks, 2 from the northeast and 4 from the east, ranged in weight from 6 to 20 kilograms, and in depth from 8 to 20 centimetres below surface. The mean depth is 13.17 centimetres below surface.

All material recovered from the 1987 excavations of ring 4b is summarized in Table 3. In total, 196 (24.5 items / sq m) cultural items were recovered from the ring. Of this total, 2 (0.25 items / sq m; 1.02%) items came from level one, 16 (2.00 items / sq m; 8.16%) from level two, 33 (4.12 items / sq m; 16.84%) from level three, 104 (13.00 items / sq m; 53.06%) from level four, 17 (2.12 items / sq m; 8.67%) from level five, 17 (2.12 items / sq m; 8.67%) from level six, 6 (0.75 items / sq m; 3.06%) from level seven, and 1 (0.5 items / sq m; 0.51%) item came from level eight.

The distribution of lithic artifacts by artifact type *versus* raw material is summarized in Table 27. A total of 86 (10.75 items / sq m) lithic artifacts were recovered from 4b, of which 47.67% (n=41; 5.12 items / sq m) were found in situ. The distribution of the lithics does not match that of cultural material in general. Level one contained only 2 (0.25 items / sq m; 2.32%) items, level two 13 (1.62 items / sq m; 15.12%) items, level three contained the greatest quantity of lithics at 25 (3.12 items / sq m; 29.07%) items, level four followed with 22 (2.75 items / sq m; 25.58%) items, levels five and six each contained 11 (1.38 items / sq m; 12.79%) items,

Ring 4b: All levels	QTZITE	S.A.	Ind.	Pebble	CHERT Ether-ington	Swan River	Montana	Avon	KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Projectile Points[1]	1						1															2
Bifaces																						
Piece Esquilles/Wedges			1																			1
Unifaces																						
Chopping Tools	1																					1
Scrapers (End/Side)				1																		1
Retouched Flakes	1		1									1					1					4
Utilized Flakes			1																			1
Cores/Core Frags.	1																					1
Decortication Flakes																						
Primary	7											1										8
Secondary	5		1									1		2			1					10
Waste Flakes																						
Shatter	6		4							1				8								19
Block Fracture																						
Secondary Flakes	10		5						1			1		2		2						21
Thinning	5		5							5		1										16
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles				1																		1
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	37		18	2			1		1	6		5		12		2	2					86

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Table 27 Frequency of Artifacts Recovered by Material, Ring 4b

level seven contained 2 (0.25 items / sq m; 2.32%) items, while no lithic artifacts were recovered from level eight. Lithic raw materials recovered from the ring include quartzite (n=37; 43.02%), assorted cherts (n=18; 20.93%), quartz (n=12; 13.95%), chalcedony (n=6; 6.98%), silicified siltstone (n=5; 5.81%), pebble chert (n=2; 2.32%), obsidian (n=2; 2.32%), argillite (n=2; 2.32%), Knife River Flint (n=1; 1.16%), and Montana chert (n=1; 1.16%).

The faunal assemblage consists of a total of 89 (11.12 items / sq m) items, of which only one is identifiable as to species. No faunal material was recovered from level one. Three (0.38 items / sq m; 3.37%) unidentifiable bone fragments were obtained from level two, 7 (0.88 items / sq m; 7.86%) from level three, 68 unidentifiable bone fragments plus 3 tooth fragments for a total of 71 (8.88 items / sq m; 79.78%) faunal remains were recovered from level 4, while levels five through eight combined amount to only 7 (0.88 items / sq m; 7.86%) unidentifiable fragments, with 1 (0.12 items / sq m; 1.12%) *Bison bison* distal phalange recovered from level seven.

A total of 21 (2.62 items / sq m) pieces of firebroken rock with a combined weight of 2080.0 grams were recovered from the 1987 excavations conducted at ring 4b. No firebroken rock was recovered from levels one and two, while only 1 (0.12 items / sq m; 4.76%) piece with a weight of 100 grams (4.81%) was obtained from level three. Level four produced most of the firebroken rock with a total of 11 (1.38 items / sq m; 52.38%) pieces with a combined weight of 1165 grams (56.01%). Level five had 5 (0.62 items / sq m; 23.81%) pieces for a combined weight of 476 grams (22.88%) while level six produced 4 (0.50 items / sq m; 19.05%) pieces for a combined weight of 339 grams (16.30%). No firebroken rock was recovered from either of level seven or eight.

Unfortunately, the inability to acquire ring rock depths severely compromises the ability to determine the depth of the living floor associated with the tipi ring as well as retarding stratigraphic separation of the two components suggested by Balcom (1987:65). This problem is augmented by the fact that the amount of cultural material recovered *in situ* is relatively low for this ring. In general, the lack of provenience data makes accurate stratigraphic separation of the two possible components impossible to obtain.

Distribution of cultural material by level only indicates an increase of material with depth, a major concentration in level four, followed by a decreasing quantity of material with depth, although levels five and six do contain equal quantities of material (Table 3). Straightforward analysis of this distribution would indicate the ring level in level four, with turbation resulting in both upward and downward movement of material. Such an interpretation would be at odds with that provided by Balcom.

Balcoms' (1987:65) impression of two components is based on changes in artifact frequency with depth.

> "The first level of [ring 4b] (2cm to 8cm) contained 49 flakes, most of which were obsidian. Level 2 (8cm to 13cm) contained 9 pieces of debitage (5 of which were quartzite). These two levels relate to the ring rocks apparent on the surface. The next level exhibits a rise in artifact count to 25 debitage and tools. Buried rocks are exposed in one corner of the unit. These have a basal depth of about 25cm. Artifacts extend below the depth of the buried ring rocks to 44cm below surface."

This distribution varies from the 1987 distribution summarized above in that I did not recover an artifact concentration from near the surface (circa 0 to 10 BS), possibly as a result of less excavation within the confines of ring 4b. In addition, Balcom recovered a greater amount of obsidian, the dominant lithic type in the upper component, than was recovered in 1987. This combination suggests that the upper component may be underrepresented in the 1987 excavations, and that the concentration of material reflected in level four documents the second component. Unfortunately, as Balcom does not specify the parametres of the second component "next level", comparisons between my level data and her second component level is impossible.

The two points recovered during the course of the 1987 excavations provide tentative support for a shallow upper component and buried lower component. Although neither point is complete, thereby making cultural specification difficult, the overall size and morphology of these points suggests that DlPb-2:7632 recovered from level two is likely Late Prehistoric, while DlPb-2:7610 recovered from level five reflects a Besant or Pelican Lake occupation. This lower component may be affiliated with the Pelican Lake ring 33c, or the Besant ring 4f. The presence of only one piece of Knife River Flint, combined with the lack of Avon chert, may indicate Pelican Lake rather than Besant affinities, although the Besant assemblage recovered from ring 4g only contains 1 Avon chert flake, and no Knife River Flint. Therefore, exact cultural placement of the buried material can not achieved.

The remaining 17 culturally unassigned rings are 3a, 3b, 3d, 4c, 4j, 4k, 32l (not including the buried Sandy Creek occupation), 33a, 33f, 33i, 33j, 34b, 34c, 34e, 34f, 34h, and 34i. None of these rings were excavated by Balcom. Excavation conducted at these rings totals 68 square metres with the majority of the rings being excavated with only a central 2m X 2m unit. Ring 4c is excluded from the following discussion as it became obvious during excavation at this location that ring 4c is a natural distribution of rock and is not a tipi ring, although one chalcedony thinning flake was recovered from the excavation.

All the culturally unassigned rings were mapped prior to excavation and these ring maps, with the exception of 321 discussed below, are presented in Appendix C. Ring measurements and rock counts for the culturally unassigned rings are presented in Appendix D. Average diametres of the rings ranged from a low of 4.04 (ring 34e) to a high of 5.47 (ring 34h) metres, with a mean of 4.76 metres. Rock counts ranged from a low of 29 (ring 34e; the table in Appendix D indicates 30 rocks because non-ring rocks [specifically #17] are not separated out in the tables) to a high of 88 (ring 33a; non-ring rocks #7, 29, 49, 62 are not separated out in the Appendix D tables) with a mean of 53 rocks per ring. The discussion on rock weights per sector for the culturally known rings provided little supportive evidence for Brumley and Dau's (1988) hypothesis concerning rock weighting and wind direction. Therefore, analysis of the culturally unassigned rings for data to either support or negate this hypothesis was not undertaken; data required to undertake such an analysis is available in Appendix D.

The ring rocks vary in depth between an average of 10.13 centimetres below surface for 34b to 15.78 centimetres below surface for 4k. The mean depth of burial, calculated by averaging the mean burial depth for each ring, is 13.21 centimetres below surface (Level 3).

A summary of all material recovered from the rings is presented in Table 3. A total of 1134 (16.68 items / sq m) cultural items were recovered from the unassigned rings. In general, the distribution of material by level is such that it appears most of the material recovered was in association with the tipi rings. Once again combining all unassigned rings together, a total of only 10 items were recovered from level one, 452 from level two, 278 from level three, 173 from level four, 146 from level five, 53 from level six, 19 from level seven, and 3 items from level eight. Although the majority of these items came from ring levels, 2 items from ring 3a are believed to come from an overlying surface component, while material recovered from levels four through eight at ring 4j (n=108; 73.97% of ring 4j cultural material assemblage), levels five & six from ring 33a (n=32, 62.74%) and levels five & six for ring 33j (n=23; 25.00%) are from buried components. The lack of diagnostic artifacts precludes assigning these buried components to cultural phases. For ring 321, the material recovered from levels one through three (n=313; 45.49%) is associated with the ring, while the material from levels four through seven is associated with the previously described Sandy Creek occupation of the site.

Appendix E contains tables summarizing the distribution of artifact types *versus* raw material types for each of the unassigned rings. For those 'rings' containing more than one component, each component is summarized separately. A total of 673 lithic artifacts were recovered from the unassigned rings. The vast majority of these artifacts (n=598; 88.86%) are associated with the ring levels, while only 75 (11.14%) came from the unassigned second components. The lithic assemblages for these rings is dominated by quartzite (n=293; 43.54%) and assorted cherts (n=228; 33.88%), followed by quartz (n=60; 8.92%), silicified siltstone (n=29; 4.31%), chalcedony (n=26; 3.86%), petrified wood (n=13; 1.93%), and minor amounts of obsidian, argillite, Swan River chert, Knife River Flint, pottery, and ochre (n=16; 2.38%). The chert assemblage is heavily influenced by ring 321 with 150 (63.02% of 321 assemblage; 22.29% of unassigned assemblage) pieces. This high percentage of chert may be indicative of a Late Prehistoric occupation for ring 321. This supposition is further supported by the fact that the ring component is well separated from the underlying Sandy Creek component radiocarbon dated to 2550 ± 90 BP (AEC-475C) indicating a date of less than 2500 BP for the ring. In addition, the only piece of pottery recovered during the 1987 field season came from this ring.

The artifact assemblage consists predominantly of secondary flakes, followed in importance by decortication flakes, tertiary flakes and waste flakes. Ring 321 displays a distribution of artifact types consistent with an emphasis on flintknapping within the confines of the ring. As was discussed for ring 32e this may reflect occupation during inclement weather. Ring 33i displays a higher incidence of formed tools, including an unclassifiable point, than do the rest of the unassigned rings. Magne (1985:257) argues that the number of tools present varies directly with the length of occupation, which would indicate a relatively long occupation for ring 33i. In general, the artifact assemblages recovered from the unassigned rings are consistent with the normal expected tipi ring assemblage.

The faunal assemblage recovered from the unassigned rings consists of a total of 224 (3.29 items / sq m) fragments. As can be seen from Table 3, the distribution of this bone among the rings is fairly equal, except for ring 4j. For those rings containing bone, densities range from a high of 83 (37.05% of the unassigned rings faunal assemblage), pieces from ring 4j, although this includes two components, to a low of 3 fragments from ring 3b. Rings 34b, 34c, 34e, and 34i contained no faunal material at all. As faunal material was recovered from rings spatially close to these four rings, the lack of material from these rings may be indicative of cultural origins. However, given the highly fragmentary nature of the faunal remains recovered from all of the rings, including the culturally assigned rings, there obviously are preservation problems in effect as well.

Very little of the bone could be speciated. The distal end of a fragmentary *Bison bison* radius was recovered from level four of ring 4j and a *Bison bison* medial phalange from level four of ring 33j.

The culturally unassigned rings yielded a total of 236 (3.47 items / sq m) pieces of firebroken rock with a combined weight of 57680.5 grams (848.24 grams / sq m). Two rings, 4k and 34b, did not contain any firebroken rock. For those rings containing firebroken rock, the distribution ranged from a high of 42 pieces in ring 34h, to a low of 3 in 34e.

As the majority of these rings (n=15) were excavated only with central 2m X 2m units, a discussion of artifact patterning is unwarranted. Two rings did see greater degrees of excavation and attempts at defining spatial patterning can be attempted. Ring 4j was excavated with a total of 8 square metres. However, as can be seen from the ring plan (Appendix C), no patterning is apparent in the distribution of the cultural material. Ring 321 was excavated with a total of 20 square metres and patterning is apparent. As can be seen from the ring map (Figure 24), ring disturbance is a problem. The tongue of rock extending into the ring from the southeast marks a cattle trail running through the middle of the ring. This will have resulted in the displacement of some material, particularly material near the surface.

As can be seen from the map, there is a definite cluster of material at the centre of the ring. Concentration number one contained 153 flakes, and concentration number two contained 25 flakes. In addition, the centre of concentration one, the enclosed dotted line, marks an area of soil staining and small scattered pieces of charcoal, although of insufficient quantity for dating. Even if the amount of charcoal was greater root contamination of the sample would likely have precluded the possibility of gaining a date from a sample of the matrix. This area of soil staining and charcoal is interpreted as being the location of an internal hearth; the scattered firebroken rock likely reflects post-depositional movement of the rock by animals moving through the ring. The high concentration of flakes within and around the stained area indicates the hearth was also used for the disposal of refuse. The second smaller flake scatter I interpret as a spot at which an individual sat while flintknapping. This interpretation is supported by the fact that all flakes contained within this concentration are thinning flakes of the same type of quartzite; it appears that an

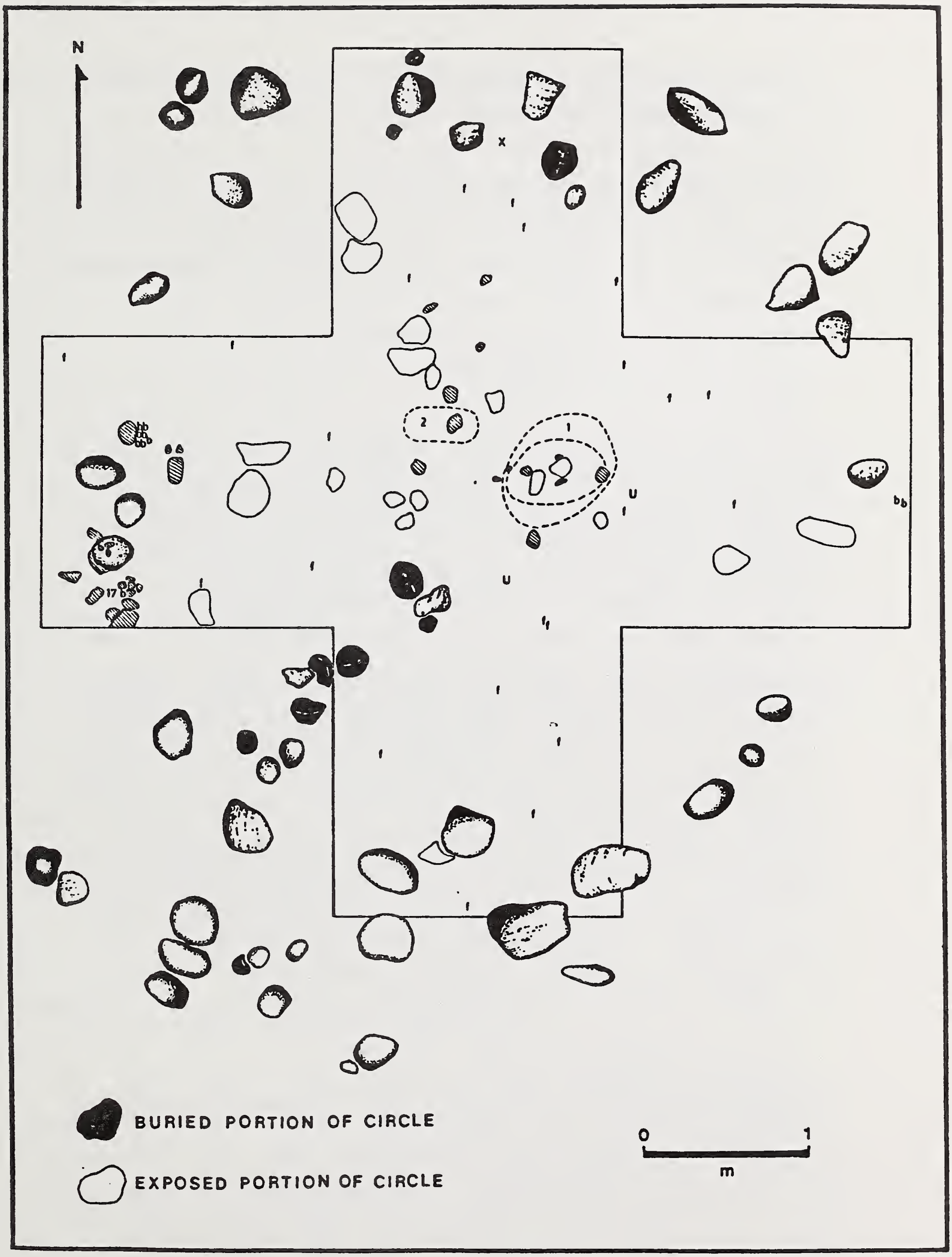

Figure 24 Feature Map, Ring 321

individual sat next to the fire while finishing the preparation of a stone tool.

The concentration of bone and firebroken rock seen at the west wall of the stone circle is more difficult to interpret. The absence of staining and charcoal from this area indicates that the stone was not heated where it presently lies. This is not surprising as a fire in this area may have caused severe structural harm to the tipi. The scattering of the firebroken rock, combined with the fact that it lies at a depth above the basal depth of the tipi ring rocks leads me to believe that the rock was not used for cooking. If it was used for cooking, I would expect a distribution similar to that described for ring 34g. In addition, as the ring contained an internal hearth, I would expect the cooking of food to have been done at the hearth. As there is a gap between this concentration of firebroken rock and the firebroken rock believed to have been associated with the hearth I doubt that the western firebroken rock was associated with the hearth; if it did arise from the hearth and was subjected to post-depositional factors causing this westward movement then I would expect that the distribution of the rock would have been continuous and not discontinuous. The fact that this rock lies above the basal depth of the ring rocks leads me to doubt that it is associated with the lower Sandy Creek component; as mentioned, the two occupations are clearly demarcated. Perhaps the rock was heated to be used as a source of heat analogous to the historic bedwarmer; the presence of the internal hearth and associated activity area may be indicative of occupation of the ring during inclement weather. The presence of bone in this area may be indicative of intentional discard, or a prehistoric example of eating in bed.

7.0 SITE SUMMARY

In this section I attempt to both briefly summarize the results of the 1987 excavation program, and to incorporate the results of Balcom's 1986 program so that a more unified description of the site as a whole is presented.

Although McKean was the earliest well documented occupation of the central area of the Cranford Site it may not be the earliest occupation of the site. It is possible that a pre-McKean buried component was located below Ring 34d. In addition, Balcom recovered a Boss Hill point from underneath ring WDc in the western portion of the site at a depth of 60 to 70 centimetres below surface. This would indicate initial occupation of the site at approximately 7700 to 7800 BP.

The McKean Complex occupation of the central area of the Cranford Site represents not only the oldest well documented occupation of the site, but also the dominant culturally identifiable occupation of the site. A total of five features, 4 rings belonging to the McKean lanceolate subgroup (rings 33d, 33g, 34d, and 34g) and 1 to the Hanna subgroup (ring 33h), plus a McKean lanceolate activity area underlying the Hanna ring, comprise the McKean Complex occupation of the central area of the site. In addition, Balcom recovered both Hanna and McKean points from the western area of the site. One Hanna point was recovered from ring WDg, as was one McKean point. Two McKean points were also recovered from ring WDc. Unfortunately the relationship between the western rings and the McKean Complex points is uncertain. In total 11 McKean points and 2 Hanna points were recovered from the site.

The total assemblage recovered from the McKean Complex in 1987 amounts to 3429 cultural items: 1190 lithic artifacts, 1751 faunal remains of which 125 mandible fragments representing two mandibles, 1 proximal phalange, 1 phalange, and a left distal humerus fragment were speciated to *Bison bison*, and 488 pieces of firebroken rock. This amounts to 49.83% of all cultural material recovered during 1987. Unfortunately, attempts to radiocabon date two hearth matrix samples recovered from the activity area were unsuccessful due to fine root contamination. It is uncertain what percentage of the material recovered from 1986 pertains to the McKean Complex.

At the Cactus Flower Site, Brumley (1975) recorded the presence of a well defined circular distribution of cultural material attributed to the McKean

Complex. He suggested that this distribution reflected the use of a conical dwelling, such as a tipi, although no evidence of a stone circle was located. At another area of excavation within the same site, he did recover a stone arc which he suggests may have been part of a tipi ring. The combination of these two discoveries lead him to suggest that McKean people did use tipis or tipi-like structures. More recently Brumley and Dau (1988:32) have suggested that "A large tipi ring site laid out in a camp circle arrangement associated with the British Block Medicine Wheel appears to date to McKean times." Data recovered from the Cranford Site indicates that the suggestion of McKean people using tipis is correct. The documentation of McKean tipi rings is, perhaps, the most significant discovery at the Cranford site as this represents the first firm evidence for the use of tipis by McKean people on the northwestern plains.

The Pelican Lake phase occupation of the central area of the Cranford Site is comprised of one or possibly two stone circles. A single Pelican Lake point was recovered from ring 33c, while the body of what is believed to be either a Pelican Lake or Besant point was recovered from the buried component of ring 4b. Attempts at determining the cultural placement of this buried component were inconclusive. A total of six Pelican Lake points were also recovered from Balcom's excavations in the western portion of the site: two from WDg, two from

WDc, and two from Test B. Unfortunately, it was not possible to separate the components in that area (Balcom 1987: 75, 86); thus the relationships between these points, the rings, and the rest of the lithic assemblage recovered with them is unclear. In addition to these seven Pelican Lake points, another Pelican Lake point was recovered from the Besant ring 4f.

The Pelican Lake assemblage recovered during 1987 consists of only 34 items comprised of 10 lithic artifacts and 24 pieces of firebroken rock. The most interesting artifact recovered from ring 33c is a grinding stone. Grinding stones are rare in Pelican Lake assemblages north of Wyoming, which may be indicative of only slight reliance on floral resources (Reeves 1983:90). Therefore, the presence of this stone may be significant, especially in light of the fact that although grinding stones could be used for processing bone, no bone was recovered from the ring. However, as only 4 square metres were excavated in ring 33c, this lack of faunal resources may be the result of sampling error.

The Sandy Creek occupation of the site is represented by an assemblage of material including a tentatively identified Sandy Creek point recovered from a buried component below ring 321. It is unclear whether or not the occupation is associated with a tipi ring; no clear evidence for a buried tipi ring was found. This occupation was radiocarbon dated to 2550 ± 90 BP (AEC 475C). The cultural material assemblage for this component consists of 375 items: 61 lithic artifacts, 219 faunal elements of which 12 have been identified as *Bison bison*, and 95 pieces of firebroken rock. No material that can be definitely ascribed to the Sandy Creek occupation was recovered during the course of the 1986 excavations.

The Besant component of the central portion of the site is comprised of rings 4f and 4g. Ring 4g was excavated both by Balcom in 1986 and myself in 1987. Balcom recovered one Besant point from ring 4g, no points were recovered from this ring in 1987. Excavation at 4f produced three Besant points as well as one Pelican Lake point. In addition to these two rings, Balcom recovered seven Besant points from ring WDg in the western area of the site.

The cultural material assemblage recovered from the Besant occupations amounts to 181 lithic artifacts, 55 faunal remains, and 77 pieces of firebroken rock for a total of 313 cultural items recovered during 1987, plus 15 lithic artifacts, 1 piece of firebroken rock, and an unknown quantity of bone recovered from ring 4g in 1986. The relationship between the seven Besant points recovered from ring WDg, the ring itself, and other material recovered from the ring is unclear.

Brumley (1983a) has suggested that Besant rings are, in general, larger than the rings of other Plains groups, and that this increased ring size is indicative of greater social complexity. However, the data from the Cranford Site does not support this interpretation. Indeed, the second smallest ring excavated at the Cranford Site is the Besant ring 4f with an average diametre of 3.90 metres. Therefore, although large Besant rings do exist (see Finnegan and Johnson 1984; Quigg 1986), the Cranford data suggests that further testing of Brumley's hypothesis may be required.

The Avonlea component of the site is represented by two rings: ring 4i excavated in 1986 and 1987 and ring 32j excavated in 1986 only. One Avonlea point was recovered from each of these two rings.

The amount of cultural material recovered from these two rings is difficult to ascertain. Excavation at ring 4i in 1987 resulted in the recovery of 51 lithic artifacts, 2 bone fragments, and 17 pieces of firebroken rock. To this can be added 75 lithic artifacts and 4 pieces of firebroken rock plus an indeterminate quantity of bone recovered in 1986 for a net total of more than 149 cultural items. Ring 32j yielded between 26 and 57 lithic artifacts, between 10 and 31 pieces of firebroken rock, plus an indeterminate quantity of bone. The difficulty in determining the quantity of firebroken rock and lithics stems from the fact that Balcom groups data by level, a necessary consequence of her methodology, and these levels crosscut the buried rings she identified at 32j.

Following Vickers (1986) and Brumley and Dau (1988) I believe it is reasonable to include a variety of small side notched points variably referred to as Plains Triangular, Plains Side Notched and Prairie Side Notched into one group termed Old Women's. Whether or not these point types reflect differing social / cultural groups or variation within one social / cultural group has not yet been demonstrated. Neither has the question of tribal identification been convincingly resolved, although the prevalent belief amongst Alberta Plains archaeologists is for a Old Women's / Blackfoot correlation (see Brumley and Dau 1988; Reeves 1983; Vickers 1986).

Excavation conducted in 1987 yielded two Old Women's phase occupations, rings 4h and 32e. One projectile point was recovered from each of these rings. To this can be added Balcom's six Plains Side Notched points recovered from two western rings and one test pit, WDg (n=3), WDc (n=2), test 105 (n=1), 3 Plains Triangular points from ring WDg, 4 Prairie Side Notched points from ring WDg and 1 from ring WDe. This represents a total of 14 Old Women's phase points recovered from the western area of the site, plus 2 from the central area of the site for a total of 16 Old Women's points which makes it the most common point type recovered from the Cranford Site.

The central area cultural material assemblage for the Old Women's phase consists of 468 items comprised of 201 lithic artifacts, 164 faunal remains, and 103 pieces of firebroken rock. As has been mentioned, the material from the western portion of the site can not be culturally delineated.

8.0 DISCUSSION

8.1 Site Selection

Balcom (1987:106) indicates "... that DlPb-2 must not be thought of as a multiple tipi ring site with one large contemporaneous occupation". As the above summary has indicated, this is indeed the case. This then leads to the question of why the site was repeatedly occupied for what may have been in excess of 7000 years.

The factors which I believe are of paramount importance for the continued reoccupation of the site are, not necessarily in order of importance, a) availability of wood, b) availability of water, particularly during the summer and fall when water is relatively scarce on the prairies, c) the ability to acquire game (ie. food) from nearby, d) the availability of stone both for holding down the tipi covers and for heating-up to use for cooking etc., and e) the availability of raw material for the production of artifacts. I suggest the conjunction of these resources at this locale accounts for the repeated occupation of DlPb-2.

That each of items (a) through (e) is available either directly on site or very near site can be quickly demonstrated. Wood is presently available in the river bottom, as well as in a seasonal stream channel to the west of the site. In addition, Balcom has also suggested that wood may have been available prehistorically in the relic channel to the south of the site. Even during the warmer and drier McKean occupation wood was likely available in the river bottom even if not available from the other mentioned sources.

Given the fact that the site locale provides easy access to the Oldman River, I believe it is safe to say that the availability of water was never a serious problem. Even during the McKean occupation I expect the Oldman River contained water.

The presence of the kill site to the southwest of the site indicates that game was available in the immediate vicinity. Even if the kill does not share the long history of use, game was still likely available near the site. As can be seen from Plates 7 and 8, the view from the site is extensive. This would allow site occupants to watch for animals coming to water for a considerable distance either upstream or downstream. In addition, the topography of the valley walls likely allowed hunters to stalk the game, and reach an effective killing range

Plate 7 View downstream of Oldman River from DlPb-2.
General view northeast.

Plate 8 View upstream of Oldman River from DlPb-2.
General View westnorthwest.

without the animals being aware of their presence (see Brumley and Dau 1988 for further related discussion).

Possible evidence for a long history of use for the kill site comes from Balcom's (1987:113-114) query as to why there were both a) greater numbers of features and artifacts per unit area, and b) a greater number of reoccupation episodes, for the western portion of the site. One conceivable reason for this is that the kill site noted in 1987 is located to the west of the site, therefore this 'increased occupation' of the western area of the site may be related to use of the kill site. However, it should be mentioned that as a result of the 1987 excavation the greater densities of artifacts, features, and reoccupations, for the west of the site as seen by Balcom is no longer as significant as it was perceived to be by her. Excavation within the central area of the site has documented occupation back as far as McKean, and perhaps earlier, rather than centred around Besant and Avonlea, the only identifiable point types recovered by Balcom in 1986. The western area may display a greater level of reoccupation per unit of area, as seen from the variety of points recovered per 'ring', but the total history of occupation may not be any greater than that of the central area.

For evidence of the availability of stone for stone boiling and to use as ring rocks, one need look no further than the two gravel pits excavated by

Alberta Transportation. That the availability of stone is, indeed, an important factor can be seen by the amount of stone imported to Head-Smashed-In, (Brink et al. 1986) and the Wells Site (Stuart 1988).

The importance of point e), the availability of raw material, was not noted until after analysis of the lithic assemblages. As is discussed in greater detail below, the lithic assemblages of all cultural groups occupying the site are dominated by locally available quartzite and chert, with one minor exception. The Besant ring 4f assemblage, although dominated by quartzite, contained more Knife River Flint / brown chalcedony than local chert. Nevertheless, the predominance of local material I suggest results from another reason for continued reoccupation of the site, namely the nearby availability of workable quartzites and cherts.

8.2 Seasonality of Occupation

Although the above may document why the site was reoccupied, it provides little information as to when, from a seasonal perspective, the site was occupied. As mentioned briefly during the discussion of the McKean assemblage, I believe the site to have been occupied during the summer, although spring through fall occupations are also likely.

Balcom (1987:114 after Binford 1978) notes that intensive butchering is indicative of tough times, and argues that this, in combination with

> "the foetal bone, the interior hearths, the great quantities of FBR in the West, the predominance of artifacts in the rings, the small heavy - set rings, and the probable presence of wood, all suggests at least intermittent winter / spring occupation",

especially in the west. Although I agree the recovery of foetal bone indicates a winter / spring occupation, I don't believe the site served principally for winter / spring occupations.

Bone recovered from tipi ring sites in Alberta is almost invariably highly fragmented. This indicates that either Plains people were continually undergoing tough times or that some other factor, quite possibly linked to preservation, is in operation (see also Brumley and Dau 1988:204). Preservational problems may also explain why foetal bone was recovered in 1986 (Balcom 1987) but not in 1987.

The open location of the site presents strong argument against a winter occupation, although a spring occupation is acceptable; winter campsites tend to be located in well sheltered environs. Therefore, I would expect a winter occupation to be on a lower terrace, such as is the case for DjPl-100, a multi-component campsite located on a low terrace of the Oldman River near the Oldman River Dam site (Stuart and Brumley 1987). In addition, Brumley and Dau (1988:91) suggest "that sites along the valley rims were largely occupied from mid spring to early fall, depending on associated water and wood resources."

The presence of foetal bone from the western portion of the site does suggest a winter / spring occupation. However, the fact that it was recovered from only two locations -- rock alignment WDk, and level four of ring WDc -- indicates that winter / spring occupations were infrequent. If the site was reoccupied during this time period as often as the variation in point styles indicates it was reoccupied, then a greater amount of foetal bone, and the recovery of foetal bone from more than one area of the site would be expected.

Balcom's argument concerning the presence of internal hearths does receive support from the 1987 excavations. All rings excavated during 1987, except for 4k and 34b, did contain firebroken rock. In addition, rings 3d, 4h, 32e, 32l, 34h, 33g, plus rings 32j, WDc, WDg, WDi, and WDj excavated in 1986 (Balcom 1987) all contain some evidence for internal hearths. However, I am not convinced that the presence of an internal hearth is indicative of a winter / spring occupation. Even during the summer, night temperatures can reach levels low enough to warrant a small hearth for warmth, especially during inclement weather. Brumley and Dau (1988) also indicate that there exists a generally positive correlation between the frequency of central hearths and the location of sites in areas with greater resource potential, which, for reasons discussed above, would include the Cranford Site area. This relationship in turn is directly related to the fact that areas with greater potential resources more likely reflect greater lengths of occupation.

Balcom's excavations indicated a predominance of artifacts within the rings, implying, therefor that more time was spent inside the tipi as would be expected during the winter. However, the 1987 excavations, in particular the recovery of a McKean activity area and an activity area underlying ring 4g, indicate that this is no longer the case. The amount of material recovered from these activity areas, in particular the McKean activity area, indicate that a great deal of time was spent outside of the shelter of the tipi.

In light of the recovery of more data, Balcom's postulation of small heavy set rings may also be questioned. In comparing her results with investigations in Crawling Valley (ARESCO Ltd. 1984) and Forty Mile Coulee (Brumley 1983b), Balcom (1987:106) indicates that the average Cranford ring is larger than the average Crawling Valley ring, and only slightly smaller than the average Forty Mile Coulee ring. Her postulation of "heavy set" appears to have been based on the assumption that as many of the rings were partially buried not all ring rocks would have been surficially visible and each ring would, therefore, contain more rock then the average number of 57 noted. Mapping of rings in 1987 employed probes to find buried ring rocks and therefore compensates for the lack of surficial visibility. As can be seen from the ring maps, the rings do not appear to be particularly heavy set and average only 54 rocks per ring.

The presence of trees and shrubs Balcom suggests served as sources of wood, and the presence of this wood as indicative of use of the site during the winter / spring; the importance of wood at winter campsites has been well documented ethnographically (see Ewers 1958). However, as previously discussed, wood appears to have served as the fuel source for heating rocks in the McKean activity area, and I do not believe this activity to have taken place during the winter / spring. In addition, as mentioned above, Brumley and Dau (1988) also see wood as an important mid spring to early fall resource. Therefore, although I agree with Balcom that the presence of wood at the site was important, I don't believe it is necessarily indicative of a winter / spring occupation.

In general, although Balcom's recovery of foetal bone provides evidence for at least one winter / spring occupation, I suggest the various lines of evidence more likely reflect spring through fall, ie. warm season, occupations.

8.3 Cultural Patterning

Does the fact that the site was reoccupied by various cultural groups over a period of thousands of years shed any light on culture history? In other words, were discrete cultural patterns recovered. As stated in Section 2.3.2, identification of cultural patterning was to be based on tool typologies, frequency of occurrence of specific lithic types, stages of manufacturing process, horizontal distributions, and stone circle architecture. Given that the site is believed to have been reoccupied during approximately the same time of the year, and presumably for the same reasons, then variations in these factors likely reflects cultural differences rather than behavioural differences.

Very little variation in tool typologies attributable to culture *versus* behaviour were obtained, other than for the projectile points. Although Reeves (1983:103), for example, indicates that diamond shaped bifaces are characteristic of Avonlea, such culturally discrete artifacts were not recovered from DlPb-2. This is not surprising. The 2944 lithic artifacts recovered from the site were divided among six different components, as well as 17 unassigned rings, and 6 buried components. The net result is a very small sample size per cultural group thereby making identification of unique artifact types very difficult.

Although the artifact typologies failed to show any significant variation through time, perhaps the lithic raw material assemblages will display variations attributable to cultural differences. The data summarized here is obtained from the 1987 excavations as material from the 1986 excavations could not be placed into cultural phases. In all four McKean rings, the lithic assemblage is dominated by quartzite at 53.33% to 79.17%, with local cherts coming second. All four rings also contained quartz and silicified volcanic ash. As has been stated, the silicified volcanic ash is of importance as it was a preferred material for the manufacture of projectile points and is diagnostic of the McKean occupation at the Cranford Site. In general, the McKean ring assemblages are dominated by local quartzites and cherts, but with silicified volcanic ash as an important constituent. The McKean activity area displays a greater range of material, but local quartzites and cherts still comprise approximately 69% of the assemblage; silicified volcanic ash is also present at 2.77%. The Pelican Lake assemblage is also dominated by local quartzites and cherts, but it must be remembered that only 10 artifacts can be attributed to this phase. The Sandy Creek material is dominated by local quartzites and cherts, but obsidian is an important constituent and is the third most common material recovered. The Besant assemblage is once again dominated by local quartzite, but significant quantities of brown chalcedony and Knife River Flint were recovered from ring 4f. The Avonlea assemblage is heavily dominated by quartzite at 82% with other locally available materials comprising the rest of the assemblage. The Old Women's assemblage is dominated by quartzite at about 42% and chert, but Knife River Flint / brown chalcedony is also significant.

All lithic raw material cultural groups are dominated by locally available material, but significant variations in the minor elements do occur. The McKean complex contains a silicified volcanic ash found in none of the later components. The Sandy Creek component contains a greater percentage of obsidian than do subsequent groups. Given this factor, it is interesting to note that Balcom's ring 4b ring levels were dominated by obsidian. Perhaps the presence of this obsidian is indicative of a Sandy Creek occupation, but given the very small sample size such identification is extremely tenuous. Both Besant and Old Women's contain significant quantities of Knife River Flint / brown chalcedony. These latter two assemblages are actually very close; the only real difference between them being that 1 piece of Avon chert was recovered from the Besant assemblage.

In general, no lithic groups could be demonstrated to consist of only one cultural group. Davis (1983) undertook a similar analysis at the Pilgrim Site in the Montana Rockies and reached the same conclusion. However, as demonstrated above, the comparison of individual lithic types does separate the McKean component from other components. Davis (1983:270) also notes such linkages at the Pilgrim Site.

No significant differences in manufacturing stages could be linked to individual cultural groups. Indeed, one of the more significant variations in manufacturing stage existed between the two Besant rings.

Although the horizontal distribution of cultural material allowed for detailed discussion of individual households, in particular for ring 34g and 321, discrete cultural patterns were not noted. Once again the small sample size available for comparison retards the ability to separate horizontal distributions on cultural grounds.

Davis (1983:272) indicates that for the Pilgrim Site

> "A 1:1 (size - age) trend is evident by inspection of the four radiocarbon dated Pilgrim stone circles; that is, the averaged diametre shifts from a 4m Pelican Lake stone circle at about 3500 years BP, to a 4.7m and 4.9m Avonlea stone circle at about 1500 years BP, to a 5.4m Old Women's stone circle at about 600 years BP".

Is this trend replicated at the Cranford Site?

The lack of radiocarbon dates means that the age of the rings can not be determined as accurately as at the Pilgrim Site, but the variation in size by Phase can still be analyzed. For the McKean rings, the average diametre ranges from 5.11 to 5.41 metres. The Hanna ring displays an average diametre of 3.98

metres. The Pelican Lake ring averaged 5.04 metres in diametre. The two Besant rings averaged 3.90 and 4.69 metres in diametre. The two Avonlea rings were 4.24 and 5.18 metres in average diametre. And the two Old Women's rings averaged 5.22 and 4.64 metres in diametre. As can be seen from these values, not only is there no progressive change through time, but rings belonging to the same Phase vary as well. Although this sample is of small size and subject to statistical error as a result, such a distribution of values indicates that ring size was not culturally controlled, at least at the Cranford Site. As the McKean rings did not show much variance, some degree of cultural control as to tipi size may be in evidence. For the other groups, it appears ring size may have varied as a result of either social or behavioural factors, or, alternatively, as a result of the number of individuals living in the tipi.

In general, discrete cultural patterns, other than for specific raw material types, were not recovered from the Cranford Site. Although it is possible that such patterns do not exist and therefore could not be recovered, I doubt that this is the case. Rather, I believe the inability to document cultural patterning stems from the small sample of information available for each of the cultural groups at the site.

Although cultural patterns were not recovered, household patterns were recovered. As can be seen from analysis of rings 34g and 321 in particular, identification of discrete activities conducted within the household were identifiable.

8.4 Provenience Data

Throughout the course of the excavations, emphasis was placed on the recording of *in situ* data. Quigg (1986:56) felt that "... general distributional patterns [at the Ross Glen Site] would become apparent through the 1 metre square proveniences." Given the shallow nature of most tipi ring sites, I see this statement as true only for those sites where it has been documented that no buried components are present. To follow Quigg's rationale at Cranford would have resulted in the conclusion of mixed assemblages. Indeed, in the excavations conducted in 1986, Balcom, not expecting to find buried components, did not use *in situ* recording which necessitated the conclusion of a mixed assemblage;

> "... at the 10 - 20 cm below surface level in Ring WDc, point typologies include Plains triangular, Plains side-notched, Besant, and Pelican Lake. The next level [20 - 30 cm BS] includes Prairie side-notched, Besant, Pelican Lake, Hanna, and McKean. Thus, we have between 3000 and 4000 years of prehistory represented in an area of 36 m^2 and 20 cm of deposition".

Balcom goes on to hypothesize that given the presence of buried hearths, the ring rocks were being reused resulting in their upward migration. Had the cultural material recovered from this ring been recorded *in situ*, it is possible that data necessary to test this hypothesis could have been tested. Unfortunately, the lack of *in situ* data means that no meaningful comments can be made in regard to this hypothesis, nor to the assemblages of this or other western rings as cultural material recovered is recorded by excavation level only, and these arbitrary levels crosscut the cultural levels.

As a result of the difficulties encountered by Balcom in 1986, the research design governing the 1987 excavations emphasized the recording of *in situ* data, in combination with measuring depths and weights of ring rocks. This allowed for accurate designation of ring levels as well as separating buried from surface components. Given the fact that there are no culturally sterile levels separating the components, although ring 321 comes very close, it was only through trends in artifact density, highlighted by the accurate plotting of artifact provenience, that allowed for separation of buried and surface components. Also, it was the availability of *in situ* data which allowed for interpretation of household patterning, such as the delineation of activities within ring 34g, the identification of a single flintknapping episode conducted by an individual in ring 321, and the construction of a detailed scenario of use for the buried McKean activity area.

It is also significant that it was *in situ* recording that allowed for the quick infield separation of the buried activity area from the overlying ring. Although the identification of the buried McKean activity area would likely have been made without the benefit of the slower digging necessitated by *in situ* recording, the current trend of excavating between 4 and 5 square metres / person / day, *versus* the <2 square metres / person / day at Cranford, would greatly enhance the possibility of missing significant finds. Obviously, there is a trade-off between the amount of area excavated and the level of *in situ* recording. However, it must be remembered that the reason for site excavation is to recover data pertinent to understanding prehistory, not to see how much dirt can be moved. In general, I agree with Davis (1983:266) that "the subtleties of subsurficial relationships require a peculiar attentiveness to detail as well as the taking of observations that archaeologists should routinely record."

9.0 CONCLUSION

9.1 Summary

Alberta Transportation requested that Fedirchuk McCullough & Associates Ltd. conduct mitigative excavations in the Central Area of the Cranford Site, DlPb-2, so that aggregate extraction may proceed in that portion of the aggregate lease.

The Cranford Site, a multi-component stone circle site located on the south bank of the Oldman River in south central Alberta, consists of 87 rings, 5 cairns, a rock alignment, and surface and buried lithic concentrations. The Central Area of the site consists of 38 stone circles, all of which have now been mapped and excavated. Excavation of 220 square metres during 1987 resulted in the recovery of 2944 lithic artifacts, 2772 faunal remains, and 1165 pieces of firebroken rock, for a total of 6881 cultural items. Six different components, as based on projectile point typologies, were identified for the Central Area as a result of the 1987 excavations: McKean (including Hanna), Pelican Lake, Sandy Creek, Besant, Avonlea, and Old Women's (comprised of Prairie Side Notched and Plains Side Notched).

9.2 Research Design - Evaluation of Results

The specific problems to have been addressed by the project were: 1) vertical spatial relationships between the remains associated with the surficial stone circles and those associated with the buried stone circles, 2) temporal/cultural affiliation of the surficial and buried assemblages, 3) identification of discernible cultural patterning within the surficial stone circle complex and within the buried stone circles, 4) prehistoric environments in the site area, and 5) the place of DlPb-2 within the existing cultural-historical context of the northwestern plains.

9.2.1 Vertical Spatial Relationship

The recovery of *in situ* data combined with depth below surface measurements conducted on the ring rocks did allow for fairly specific and accurate identification of living floors. In addition, although areas of overlap did exist, separation between buried and surficial components was fairly well demarcated.

9.2.2 Temporal/Cultural Affiliation of Assemblages

It was hoped that samples suitable for radiocarbon analysis could be obtained from the central area of the site. Unfortunately, this did not work out as well as was anticipated. With one exception, the hearth matrix samples submitted could not be dated due to fine root contamination. Bone recovered from the site was highly fragmentary, pieces of suitable size for conventional radiocarbon dating were not recovered. Although recent developments in radiocarbon dating, in particular the use of tandem accelerator mass spectrometres, allows dating of less than one gram of test material, such dating was financially prohibited. As a result, temporal/cultural affiliation, with the exception of the ring 321 Sandy Creek component, was limited to the recovery of diagnostic points. However, as bone was recovered *in situ*, if funds were made available then the majority of the rings could be precisely dated.

9.2.3 Identification of Cultural Patterning

The use of provenience data allowed for detailed constructions of household patterns for some of the rings, the best examples being rings 34g and 32l. On the other hand, the ability to construct discrete cultural patterns achieved only limited success. The reasons for this, as mentioned, revolve around sample size. First, the number of occupations recovered from the central area was much greater than anticipated; Balcom (1987) recovered only Besant from the specific area under investigation, although Avonlea was recovered from ring 32j immediately adjacent to the area under discussion. The fact that several components, based on projectile point typology, were recovered from the western area of the site was perceived by Balcom as being unique to that area of the site; the material she recovered from the central area of the site did not indicate comparable occupation. Compounding this problem was the limited amount of excavation conducted per ring; in order to document cultural patterning a greater amount of excavation per ring is required. Deaver (1983; see also O'Connell 1987), for example, concludes that excavation of 1/2 of the ring, plus excavation of 4m X 4m units located in inter-ring areas is necessary to recover a representative collection. This level of excavation is substantially larger than the amount of excavation conducted at the Cranford Site.

9.2.4 Prehistoric Site Environments

The lack of the palynological data limits evaluation of the reconstruction of the palaeoenvironmental record to the carbon isotope data. The results of this analysis indicates that this procedure may have great value for the reconstruction of palaeoenvironments at sites which contain bone, even when this bone is highly fragmentary such as at the Cranford Site. Indeed, given the nature of pollen preservation in Chernozem soils, I would expect that the results seen for the isotope record are of better quality than will be the palynological record.

9.2.5 DlPb-2 in Northwestern Plains Prehistory

The fact that the Cranford Site appears to have been seasonally reoccupied by diverse cultural groups over a period of thousands of years indicates amazing stability in past land use patterns. This on going, although assuredly not yearly, reoccupation suggests that a fairly stable pattern of seasonal movement and land use was shared by a variety of cultural groups through a long period of time. This is especially interesting in regard to the McKean occupation.

Although the origins of McKean are ambiguous, it is generally held to be intrusive into Alberta (Vickers 1986:71-72). For this reason, it is intriguing to note the presence of McKean at this seasonally reoccupied site as it indicates that although McKean people may have been intrusive to the area, they apparently followed a cultural round similar to populations which were both culturally and temporally distinct from them. Nevertheless, the McKean occupants clearly differ from other groups utilizing the Cranford site locale.

The fact that silicified volcanic ash does not show up in any non-McKean assemblages indicates that the McKean people occupying the Cranford site had ties with people in the source area for this material and received it through trade, or that they themselves moved through the source area, and, more importantly, that no other Cranford Site occupant appears to have had similar ties or movements. The presence of the silicified volcanic ash therefore supports the supposition that McKean occupations are intrusive.

The presence of Sandy Creek, although only tentatively identified, is noteworthy. Sandy Creek, as defined by Wettlaufer (1955) at the Mortlach site in Saskatchewan, is generally seen as an outgrowth of Oxbow (Dyck 1983:108; Reeves 1983:13). Reeves (1983:14) further suggests that Besant appears to be technologically derived from Oxbow through Sandy Creek: "Sandy Creek persisted in the Parklands during Pelican Lake times, emerging around the time of Christ as the Besant Phase ...". The presence of Sandy Creek at Cranford with a date of 2550 ± 90 BP (AEC 475C) tends to argue against this hypothesis.

In general, the presence of Sandy Creek, particularly with a relatively early date, further obfuscates the already murky picture of Besant origins.

One further problem concerning the Besant occupation of the Cranford site is presented in the ring 4f assemblage where one Pelican Lake and three Besant points were recovered. In dealing with the combination of Pelican Lake and Besant points recovered from the Bow Bottom Site, Van Dyke and Head (1983) argue that mixed assemblages of these points may arise from the missidentification of Kootenay Plains Side Notched as Besant. This argument, however, is limited to the Rocky Mountains and foothills, and is unlikely to apply to the Cranford Site. As there is no evidence for a buried component at ring 4f, it appears the association of Besant and Pelican Lake points is correct. However, it is not known if this association is the result of actual Pelican Lake - Besant interaction, post depositional movement of the lone Pelican Lake point by animal or man, or accidental inclusion as a result of two temporally separate occupations of the same spot. In general, the data recovered from Cranford do not further elucidate possible Besant - Pelican Lake interactions.

Overall, the Cranford Site has added to our knowledge of warm season occupations for a number of cultural groups over a long period of time. This is important as there is little archaeological data relating to warm season occupations (Vickers 1988:5). It has been suggested that summer occupations consisted of band sized (Morgan 1979) to tribal sized (Ewers 1958) population aggregations. However, excavation of DlPb-2 does not support this supposition. Excavation of the Cranford Site revealed a palimpsest of occupations covering 8000 years of prehistory, with none of the occupations suggesting aggregations beyond an extended family. This is a common occurrence when large tipi ring sites are excavated; a tribal sized occupation as described ethnohistorically has yet to be positively identified (Vickers 1988:5). This strongly suggests that prehistoric pedestrian population movements were substantially different than post-horse population movements. Only through further research at other large tipi ring sites will information pertinent to a discussion of past population movements, and the social and political aspects of prehistoric group aggregation, be obtained.

10.0 RECOMMENDATIONS

The work described within this report constitutes final mitigation of impact to the central area of the Cranford Site, DlPb-2, by and for aggregate extraction activities. No further work pursuant to the use of this area for aggregate extraction is recommended. However, it is recommended that the fenced-off portion of the western area of the site remain fenced so as to preserve this area for future research.

During the course of evaluating the research design in light of the results obtained, frequent mention of the sample size was made. As large campsites tend to contain a few rings from many time periods rather than many rings from a few time periods the level of excavation per ring must be high enough to collect a representative sample of the material contained within the ring in order to attain a representative sample for the cultural group to which the ring belongs. Only through higher levels of excavation will evidence for cultural patterning be recovered. Therefore, on those tipi ring sites where excavation is warranted, it is recommended that levels of excavation be increased to a level whereby the total amount of excavation to be conducted is equal to at least half of the total ring area (ie. the amount of area inside the rings, not the area covered by the site as a whole). Following such a procedure within the central area of the Cranford Site would have resulted in the excavation of approximately 600 square metres, or about double the amount of area excavated during 1986 and 1987. This would likely have resulted in increasing the number on culturally known rings and thereby provide information crucial to the discussion of cultural patterning; in spite of the excavation of at least one 2m X 2m unit in each Central area ring, the culturally unassigned rings still make up the majority of the sample. Although increasing amounts of excavation will result in increases in cost, if research into topics such as cultural patterning or site structure (see O'Connell 1987) is to be conducted, then greater levels of excavation are required.

Work conducted at the Cranford Site has indicated that *in situ* recording of cultural material recovered from a tipi ring site can have considerable interpretive value. Therefore, it is recommended that the recording of *in situ* data for mitigation projects become the rule rather than the exception. Unfortunately, implementation of this recommendation is difficult due to the positive correlation between increasing levels of *in situ* recording and cost. However, in my opinion, the information gains of *in situ* recording for sites with artifact densities comparable to Cranford offset the increased costs such recording produces.

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INTRODUCTION

Stable isotope analysis is a relatively recent method for studying past diets and environments. The stable isotopes of carbon (^{12}C and ^{13}C) are particularly useful for these kinds of studies because of the effects plant photosynthesis has on them. Approximately 98.9% of atmospheric carbon is ^{12}C and the remaining 1.1% is ^{13}C. All carbon isotopes combine with oxygen in the atmosphere to produce carbon dioxide which is taken up by plants during photosynthesis.

Three groups of plants can be distinguished by their performance during photosynthesis (Devlin and Barker 1971; Goudriaan and Ajtay 1979; Hatch and Slack 1970; Vogel 1980). These have been termed the C_3, C_4, and CAM (crassulacean acid metabolism) plants. CAM plants are not an important part of herbivore diet in southern Alberta and so are not of concern here. C_3 plants get their name because the first photosynthetic reaction product, phosphoglycerate, has three carbon atoms. C_4 plants first bind carbon dioxide into a four carbon compound. The C_4 pathway represents adaptation to warm, bright, arid conditions. The C_3 pathway is used by most of the temperate zone grasses.

The relative amount of ^{13}C in plant tissues indicates which pathway a plant uses to fix carbon (Lerman 1975). Put another way, different photosynthetic pathways result in different degrees of isotopic fractionation; i.e., they produce different changes in the ratio of ^{13}C to ^{12}C. The ratio is derived by dividing the number of atoms of ^{13}C in a sample by the number of atoms of ^{12}C in the sample. It is usually expressed as deviations in parts per mil ($^{o}/_{oo}$) from the isotope ratio in a standard as follows:

$$\delta^{13}C\ (^{o}/_{oo})_{sample} = [(R_{sample} / R_{standard}) - 1] \times 1000$$

where $R = {}^{13}C/{}^{12}C$.

The most accepted standard is the PDB (Pee Dee Belemnite) standard which was derived from the carbonate shell of a Cretaceous mollusc, *Belemnitella americana*, from the Pee Dee Formation in South Carolina (Craig 1957).

Plants show a distinct bimodal distribution of $\delta^{13}C$ values closely correlated with the C_3 and C_4 pathways (Vogel 1980:Figure 1) and thus can be used to distinguish C_3 from C_4 plants.

ISOTOPES AND DIET STUDIES

In 1978 DeNiro and Epstein asserted that information about the isotopic composition of an animals diet may be obtained from its fossil organic remains if two conditions hold:

(1) the $\delta^{13}C$ values of preserved tissue remain unaltered by diagnetic processes, and

(2) the relationship between the $\delta^{13}C$ value of the component and the $\delta^{13}C$ value of the diet of the animal is known.

The first condition is normally met by using bone collagen as it is resistant to post-mortem environmental exchange and diagenetic degradation (see Bumsted 1984 for a review). It has also been demonstrated that animals do not substantially alter the carbon isotope composition of their food and, therefore, we can assess the relative dependence of animals on isotopically distinct categories such as C_3 and C_4 plants (cf. Tieszen *et al* 1979). Tieszen (1978) has speculated that each tissue has an isotopic memory which is a function of:

(1) $\delta^{13}C$ value of the carbon in the food at the time of synthesis,

(2) $\delta^{13}C$ value of subsequent food, and

(3) biochemical turnover rate of the tissue or component.

Carbon from previous diets is constantly broken down and replaced with carbon derived from newer diets. This turnover occurs more slowly in animals of larger size (Tieszen *et al* 1983). Bone collagen from large animals reflects the diet averaged over periods that may be as long as 10 to 20 years (Stenhouse and Baxter 1979). Long carbon turnover time averages out the effects of short term diet change caused by seasonal plant variation or limited migration.

Dietary analysis should proceed in two stages:

(1) estimate the $\delta^{13}C$ value of the diet from the $\delta^{13}C$ value of the animal carbon, and

(2) determine the relative contribution of potential dietary sources of known $\delta^{13}C$ values which would produce the $\delta^{13}C$ value from step 1 (DeNiro and Epstein 1978).

VEGETATION AND CLIMATE

There is a high correlation between C_3-C_4 distribution and temperature and precipitation. C_4 grasses become more abundant in terms of biomass and increase as a percent of species as temperature increases and precipitation decreases (Boutton *et al* 1980; Teeri 1979).

$\delta^{13}C$ values can be used to calculate the contributions of C_3 and C_4 plants to a vegetation community. Conversion to percentages of C_3 and C_4 can be accomplished by interpolating between the $\delta^{13}C$ values at 100% C_3 and 100% C_4 contribution to the plant cover (Ode *et al* 1980). As well it has been shown that carbon isotope values can be used as indicators of relative amounts of C_3 and C_4 plants in rumen samples in herbivores (Tieszen *et al* 1979).

BISON DIET

An important question in dealing with bison diet is: Were they eating what was there? There are three potential problem areas in answering this question:

(1) Competition - Bison were once the most abundant large herbivore in southern Alberta where they faced only limited competition from other ungulates such as moose, deer, elk, and antelope (Cairns 1976). The former are browsers and tend not to locate on the open plains. Antelope, who do graze on the plains, tend to eat parts of plants that bison ignore (Peden 1972). The only other competition for food resources the bison faced was from voles and grasshoppers (McHugh 1972:222) and from prairie dogs (Webb 1959:39) who are generally not selective.

(2) Migration - It is now generally believed that bison movement was of a localized flexible nature in response to conditions of the food supply (Arthur 1975; Hanson 1984; McHugh 1972; Roe 1951). In southern Alberta the Chinook phenomena made grasses available during winter on a fairly regular basis and this easier winter foraging probably removed much of the necessity for regular movement to more sheltered areas or to areas of more abundant forage (Moodie and Ray 1976).

(3) Selection - Bison are not generally selective in their grazing habits throughout the year and there is a high correlation between the percentage dry weight of cool and warm season grasses in diet and the percentage cover on the ground for most of the year (Peden *et al* 1974).

It is probable that current bison behavior and diet accurately reflect past behaviors in eating habits and it follows that bison at Cranford were eating a representative sample of forage found in the area. As forage composition is determined primarily by prevailing climate both climate and diet are reflected in Cranford bison bone chemistry.

VEGETATION IN SOUTHERN ALBERTA

In prehistoric times, grassland covered most of southern Alberta. The former vegetative patterns are still reflected in the types of grassland that exist in wide concentric circles that are centered on the southeast corner of the province (Morgan 1980). This pattern is a result of different temperature and moisture regimes in different areas (Coupland 1961; North 1976).

A number of researchers have classified the grassland vegetation of southern Alberta. Coupland (1961) classified six major grassland communities, five of the Mixed Prairie and one of the Fescue Prairie. Morgan (1980) divided the Mixed Prairie into two categories, the Mesic Mixed Prairie and the Xeric Mixed Prairie. Coupland (1961) measured the botanical composition and calculated the proportion of principle species for the different vegetative types in a number of locations in Alberta and Saskatchewan. From his data, it is possible to extrapolate rough percentages of particular species in the vegetative zones. *Bouteloua gracilis*, the only dominant C_4 grass in southwestern Alberta, comprised approximately 1.0% of the vegetative cover in the Fescue Prairie. This rose to approximately 14.5% in the Mesic Mixed Prairie and then increased again to a minimum of 37.0% and a maximum of 56.5% in the Xeric Mixed Prairie. The Cranford site is located in the present-day Xeric Mixed Prairie.

Increasing moisture or temperature regimes have a dramatic effect on the percentage of C_4 grass in the vegetative cover. For example, in the first half of the 1950's, there was more annual rainfall on the Prairie Provinces than there was during the 1940's. This was reflected in the data gathered by Coupland (1961) which showed decreases of as much as 15% in the percentage cover composition of *Bouteloua gracilis* from the 1940's to the 1950's.

METHOD AND RESULTS

Individual bone samples for analysis were selected from the Cranford material excavated during 1987 on the basis of obtaining representative samples from identifiable rings. Collagen was extracted and purified according to the method described by Longin (1971) and evaluated by Chisholm *et al* (1983). The method used for combustion is that described by Sofer (1980). Samples were run on a mass spectrometer built around a Micromass 903 in the Department of Physics at the University of Calgary.

The $\delta^{13}C$ values of the samples and percent C_4 calculations are presented in Table 1. These are compared in Figure 1 to a previous analysis of carbon isotope values from the Head-Smashed-In Buffalo Jump in southwestern Alberta (McKinnon 1986). The dates for the Cranford data are assigned very arbitrarily based on the Alberta paleocultural sequence (see Vickers 1986 for a review). With the exception of sample #10 (2550±90 B.P.) the dates assigned could be off as much as 1000 years although they are in the accepted relative sequence. Statistics for the Cranford and Head-Smashed-In samples are presented in Table 2.

Shifts in $\delta^{13}C$ values are apparent at both sites. The Head-Smashed-In data is shown oscillating about a mean of -19.6. This can be translated into a bison diet component of approximately 13.6% C_4 grass. Cranford values are generally closer to zero and thus reflect a bison diet containing more C_4 grass. The Head-Smashed-In data show four distinct periods when more C_4 grass was growing and at least three periods when the vegetative cover contained less C_4 grass than at present. It also shows that C_4 grass in bison diet varied from zero to greater than 24% during the period the site was in use. The Cranford data indicate that bison diet contained from 12 to 42% C_4 grass during the period of site use. Average percentage of C_4 grass in bison diet at Cranford is 24.3%.

McKinnon (1986) developed a process to construct temperature and precipitation curves at Head-Smashed-In. These curves showed only the minimum temperature changes necessary to account for the variation in the data. The curves were based on previously discovered relationships between C_4 biomass and climatic variables (Boutton *et al* 1980). Climatic values calculated were developed from the average C_4 biomass growing over a bison's lifetime, and are, therefore, simply "snapshots" of the situation over a relatively short temporal period. Buchner (1980) has emphasized the extreme year-to-year variability of grassland climate. Consequently, the palaeoclimatic evidence must be interpreted as relatively short term averages that may mask more extreme fluctuations. As well, the gaps between the "short terms" probably hide a great deal of variability. McKinnon (1986) also assumed that temperature and precipitation are functions of one another insofar as they affect C_4 biomass. Thus, for example, a C_4 biomass of 24.3% can be the result of a mean annual temperature of 6.3°C and total annual precipitation of 41.2 cm. This does not preclude the same level of C_4 grass growing when temperature and precipitation are both increased or decreased. Assuming that temperature and precipitation are linear functions of the same third variable does not allow for cold/dry or warm/wet variations. Thus, it can be seen that the values arrived at probably err on the conservative side in terms of distance from the mean. As the overall objective is to attempt to locate times of climate change, errors in size do not inhibit the interpretation. They will, however, cause "rate of change" or magnitude calculations to be conservative. The data indicate that the average mean annual temperature at Head-Smashed-In has been 5.3°C for the past 5650 years. This is very close to the present mean annual temperature, in the area, of 5.4°C. The situation is similar for total annual precipitation. The overall average precipitation at the site for the past 5650 years is 43.4 cm. Present total annual precipitation also averages 43.4 cm (McKinnon 1986).

Utilizing the same formulae for Cranford shows mean annual temperature extremes of 5.2°C and 7.9°C with an average mean annual temperature of 6.3°C. Extremes of total annual precipitation at Cranford are 37.7 cm and 43.7 cm with an average of 41.2 cm. It must be emphasized that these values should be viewed only as rough approximations as they are developed from formulae constructed specifically for the Head-Smashed-In area.
McKinnon (1986:Figures 6.4 and 6.5) divided his graphs into climatic episodes in the manner of Bryson and Wendland (1967). The boundaries are approximations because of the gaps between sample times and the very tentative assignment of dates. Based on the very arbitrary assignment of dates the Cranford data generally appear to fit an episodic model although timing is very problematical.

$\delta^{13}C$ values for Cranford are averaged by level (Table 3) and by cultural designation (Table 4). Averaging the data by level shows a trend toward less C_4 grass in bison diet (Figure 2) between level 6-7 (39.3%) and level 2 (18.6%). This decrease of over 20% in C_4 biomass probably indicates dramatic enough changes to precipitation and temperature regimes to be classed as episodic.

Figure 3 shows the Cranford $\delta^{13}C$ values averaged by cultural designation and then arbitrarily assigned dates based on the mid-points of the designated culture time periods. Again a trend toward less C_4 in diet is indicated. Figure 4 is the same data as Figure 3 with the arbitrary assigned dates removed. The figure demonstrates that, on average, C_4 grass had decreased from 27.9% to 15.0% of bison diet between McKean (5000 - 3000 B.P.) and Besant (2000 - 1150 B.P.) occupations. This does not mean the climate was consistently hotter or drier during the McKean occupation. The graph shows only the average of a number of diets averaged over a bisons lifetime. In the same way it can be seen that hotter or drier conditions prevailed at least once during the Late Prehistoric probably followed by a period of cooler, wetter weather.

In summary, bison at Cranford generally appear to be eating more C_4 grass in all time periods than were the bison at Head-Smashed-In. This is to be expected given the locations of Head-Smashed-In, on the Fescue Prairie/Mesic Mixed Prairie boundary, and Cranford, 80 km to the east in the Xeric Mixed Prairie.

ACKNOWLEDGEMENTS

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Table 1

$\delta^{13}C$ Values of Cranford Samples

Sample	Ring	Unit	Level	$\delta^{13}C$	% C_4	Cultural Designation
1*	4i	3	3	?	?	Avonlea
2	4f	13	3	-18.9	18.6	Besant
3	4f	14	3	-19.8	12.1	Besant
4	34g	14	3	-18.2	23.6	McKean
5	34g	13	4	-18.6	20.7	McKean
6	32e	7	3	-19.7	12.9	Plains Side Notched
7	321	16	2	-18.1	24.3	Late Prehistoric?
8	321	17	3	-18.4	22.1	Late Prehistoric?
9	321	19	4	-18.4	22.1	Sandy Creek
10	321	4	5	-17.9	25.7	Sandy Creek
11	321	17	6	-17.5	28.6	Sandy Creek
12	321	1	7	-17.9	25.7	Sandy Creek
13	33h	37	3	-17.4	29.3	Hanna - McKean
14	33h	26	4	-18.2	23.6	McKean
15	33h	28	5	-18.5	21.4	McKean
16	33h	38	6	-15.6	42.1	McKean
17	33h	28	6-7	-16.0	39.3	McKean
18	33h	28	7	-18.2	23.6	McKean

* Sample destroyed during processing

Table 2

Statistics of the Cranford and Head-Smashed-In Samples

	Cranford	Head-Smashed-In
Sample Size (N)	17	44
Range (per mil)	-15.6 to -19.8	-18.1 to -21.7
Mean (per mil)	-18.1	-19.6
Median (per mil)	-18.2	-19.4
Variance (S^2)	1.08	.70
Standard Deviation (S)	1.04	.83
Standard Error of the Mean	±.25	±.13

Table 3

Cranford $\delta^{13}C$ Values Averaged by Level

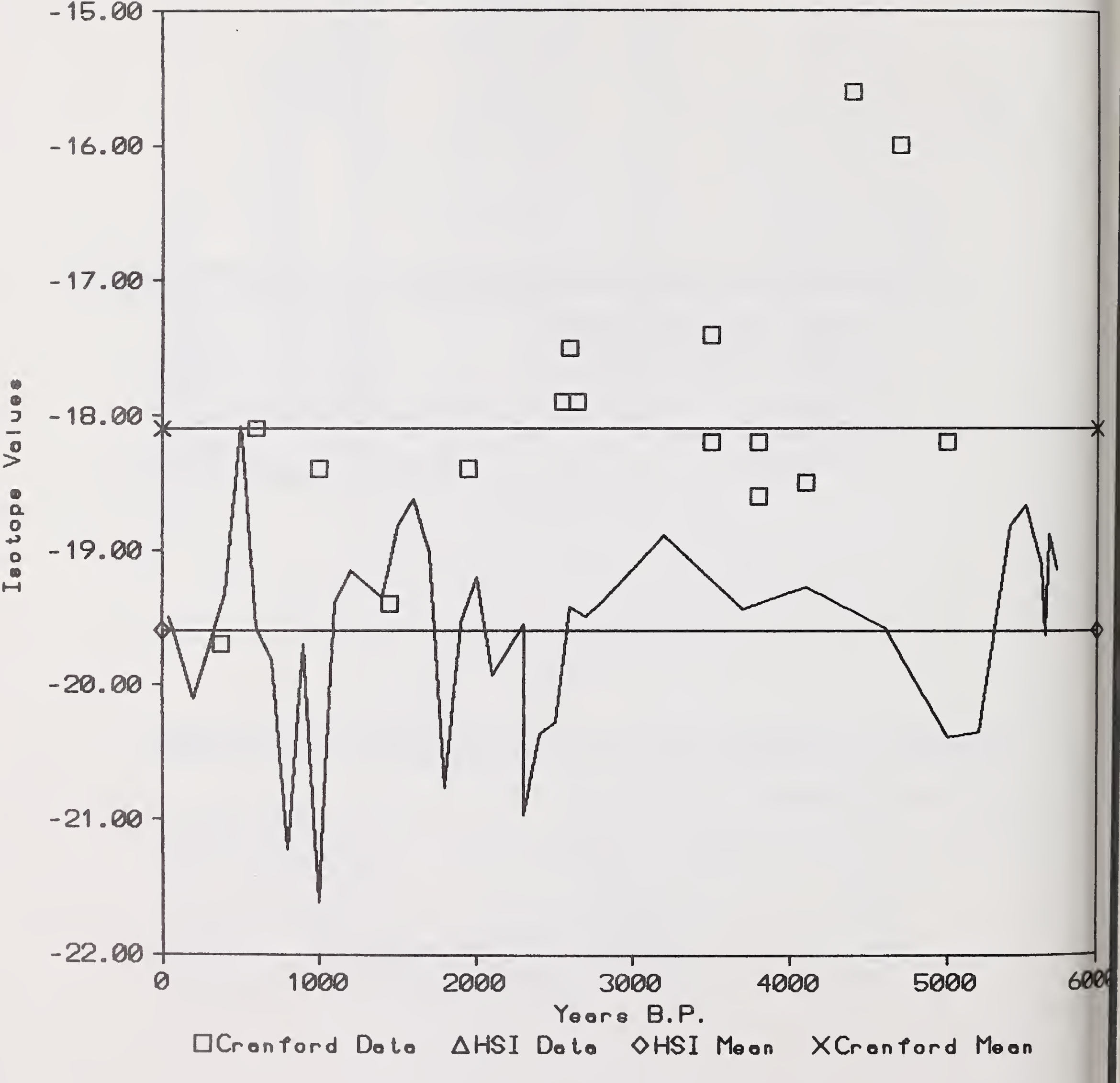
Level	n	$\delta^{13}C$	% C_4
2	1	-18.9	18.6
3	6	-18.5	21.4
4	3	-18.4	22.1
5	2	-18.2	23.6
6	2	-16.6	35.0
6-7	1	-16.0	39.3
7	2	-18.2	23.6

Table 4

Cranford $\delta^{13}C$ Values Averaged by Cultural Designation

Cultural Designation	n	$\delta^{13}C$	% C_4
Plains Side Notched	1	-19.7	12.9
Other Late Prehistoric	2	-18.3	22.9
Besant	2	-19.4	15.0
Sandy Creek	4	-17.9	25.7
McKean	8	-17.6	27.9

Fig. 1: Values by Assigned Date



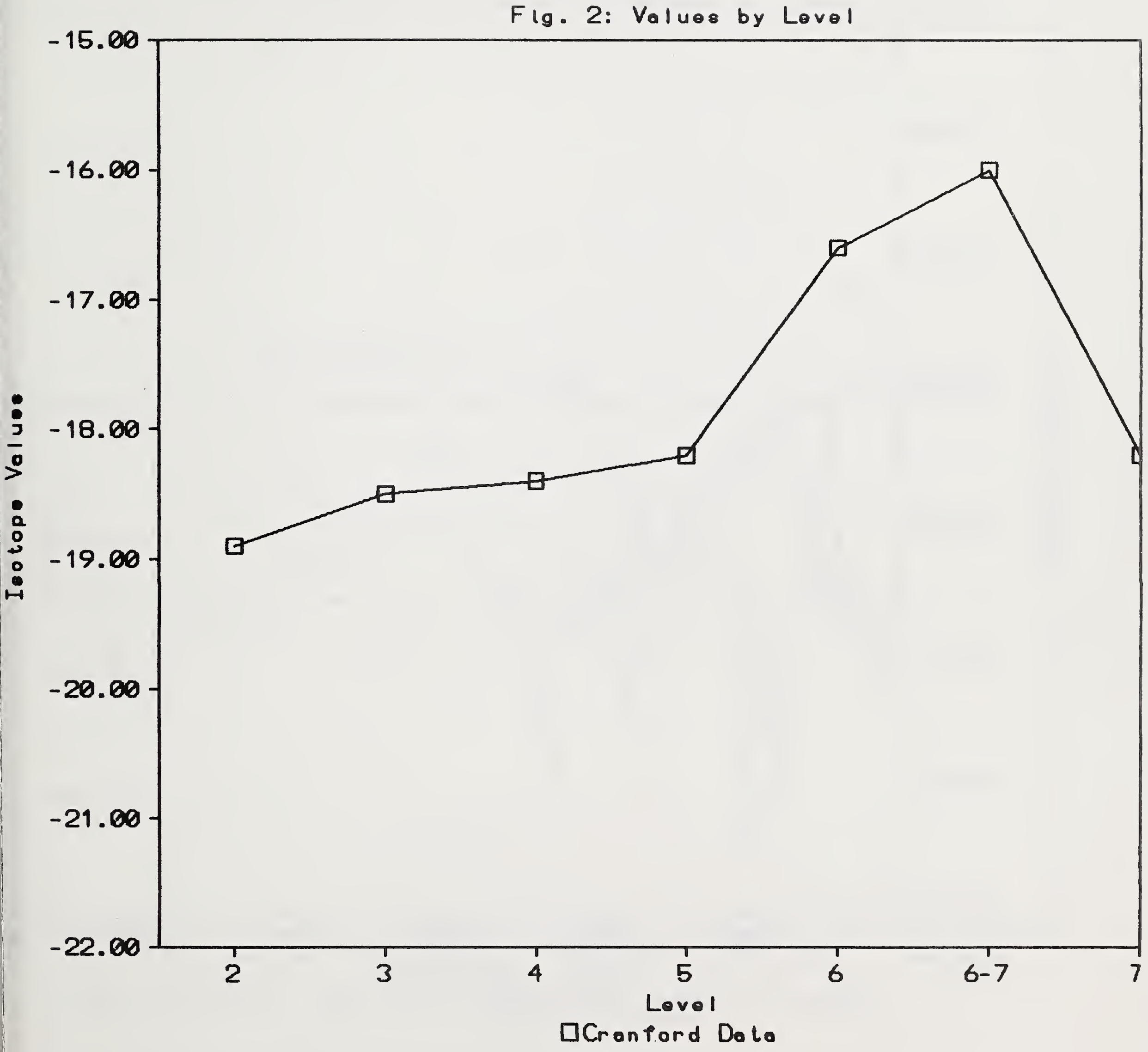
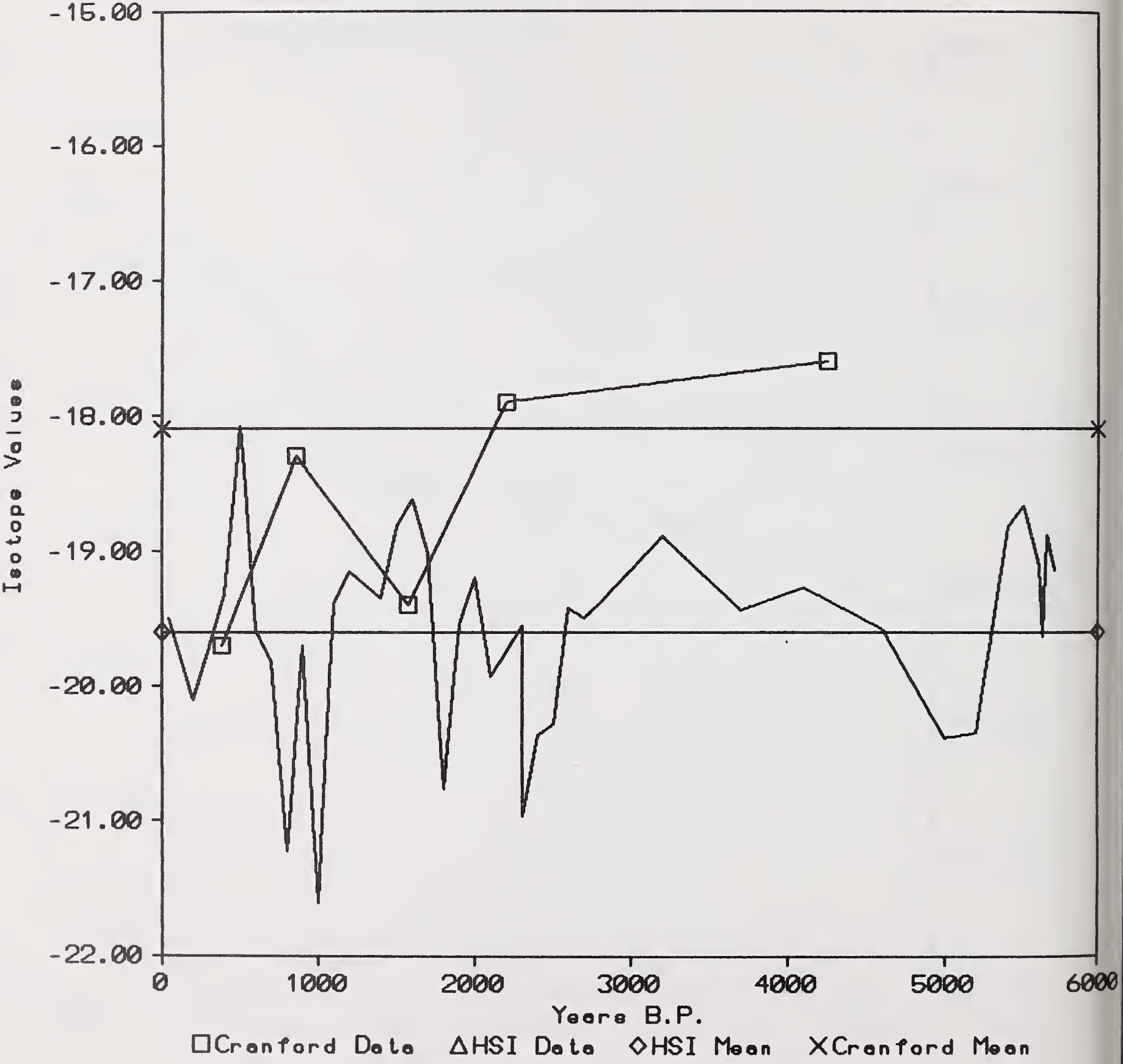


Fig. 2: Values by Level
-15.00
-16.00
-17.00
-18.00
-19.00
-20.00
-21.00
-22.00
Isotope Values
2
3
4
5
6
6-7
7
Level
☐Cranford Data

Fig. 3: Values by Assigned Culture



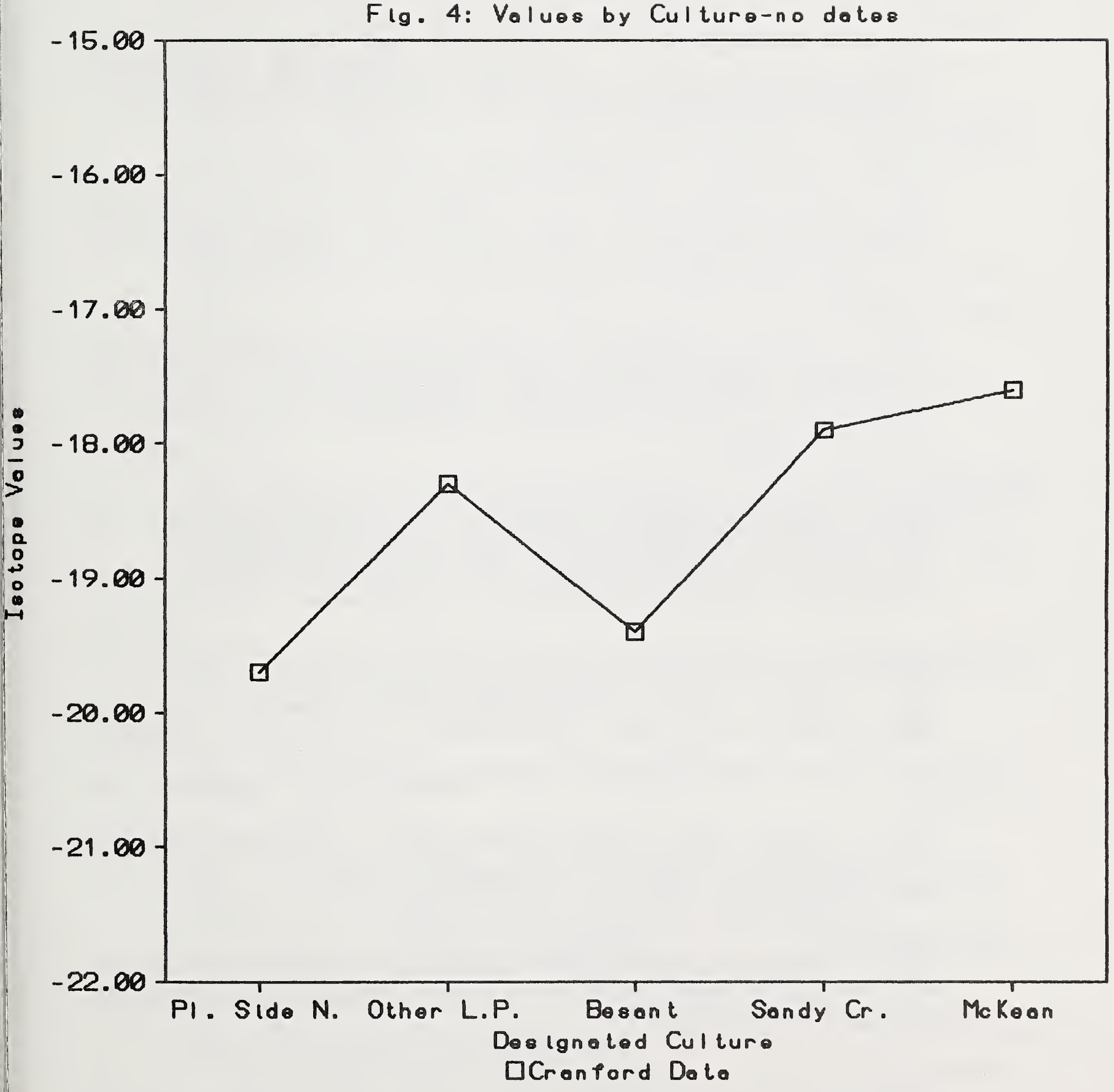


Fig. 4: Values by Culture-no dates
-15.00
-16.00
-17.00
-18.00
-19.00
-20.00
-21.00
-22.00
Isotope Values
Pl. Side N.
Other L.P.
Besant
Sandy Cr.
McKean
Designated Culture
☐Cranford Data

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APPENDIX B

During the course of the project, a total of 2944 artifacts, comprised of 2943 lithic artifacts and 1 piece of pottery, 2772 bone fragments, and 1165 pieces of FBR were recovered. These items are described below.

PROJECTILE POINTS (Plates 9 & 10)

A projectile point is a sharp edged pointed object hafted to the shaft of an arrow, atlatl dart, or spear (lance) in order to facilitate penetration. The majority of archaeologically recovered projectile points are made of stone, although wood, shell, bone, or metal could also be used.

Descriptions

DlPb-2:5147; Ring 33h; Unit 6:53N 68E; Level 5:22BS
DlPb-2:7210; Ring 33h; Unit 22:24N 76E; Level 3:14BS

This point is comprised of two pieces. The base was found in Unit 6, Level 5 while the tip came from Unit 22, Level 3 (Figures 11 & 9). The point is a complete lanceolate basally notched silicified siltstone McKean point. The asymmetrical basal notch is 4mm deep with a 10mm opening. The basal width is 19mm. The maximum width of 19mm is attained 16mm above the base; ie. approximately 2/5 of the way up the point. The maximum thickness of 6mm is attained 11mm above the base, or approximately 3/10 of the way up the point. The length of the point is 39mm. Both the overall (ie. main body of the point) and marginal (ie. edge of the point) flaking pattern consists of bifacial irregular retouch. In comparison to other McKean points recovered from the site, this is not a well formed point.

DlPb-2:5148; Ring 33h; Unit 2:49N 91E; Level 5:22BS
The object consists of a complete lanceolate basally notched silicified volcanic ash McKean point. The slightly asymmetrical basal notch is 3mm deep with a 12mm opening; this is a relatively broad and shallow notch. The basal width is 15mm. The maximum width of 23mm is located 18mm above the base; ie. approximately 2/5 of the way up the point. The maximum thickness of 7mm is attained 20mm above the base, or at the approximate midpoint of the object. The point is 41mm in length. Both the overall and marginal flaking pattern consists of random shallow bifacial retouch.

DlPb-2:6859; Ring 33h; Unit 13; Level 3:14-15BS
The object consists of an incomplete lanceolate basally notched silicified volcanic ash McKean point. The symmetrical basal notch is 3.5mm deep with a 6mm wide opening. The basal width is 16mm. The point has a maximum width of 17mm located just above the notch. The maximum thickness, also located just above the notch, is 5mm. The point is broken such that the tip of the point is missing; it is estimated that the point was originally 25 - 30mm

in length. Both the overall and marginal flaking pattern consists of random shallow bifacial retouch.

DlPb-2:6940; Ring 33h; Unit 10:92N 96E; Level 4:19BS The object consists of a complete pentagonal basally notched very fine grained quartzite McKean Point. The asymmetrical basal notch is 3mm deep with a 7mm opening. The basal width is 11mm. The maximum width of 18mm is attained at the juncture of the base and top of the pentagon (distal-lateral juncture). The maximum thickness of 5mm is attained at the same spot. The point is 18mm in length. Both the overall and marginal flaking pattern consists of random bifacial retouch.

DlPb-2:5159; Ring 33h; Unit 20:34N 86E; Level 5:25BS The object consists of the base of a small side notched obsidian point. The point has a stem length of 4mm, a shoulder width of approximately 9mm, a neck width of 7.5mm, a basal width of 10mm, a maximum basal thickness of 0.5mm, a notch height of 0.5 & 2.5mm, and a notch depth of 2.5 and approximately 0.75mm. The maximum thickness of this fragment is 2mm, this may or may not reflect the maximum thickness of the original point. The maximum width was measured across the base, although the maximum width may have been across the shoulders and was obliterated by point breakage. The original point length cannot be determined from this fragment. Both the overall flaking pattern and the marginal flaking pattern is bifacial irregular. Only one notch is well preserved on this point, breakage immediately above second notch makes measurement of this notch difficult, but it appears to be more poorly defined (ie. smaller) than the first notch.

DlPb-2:5154; Ring 34g; Unit 4; Level 2:5-10BS

The object consists of a complete lanceolate basally notched Swan River chert McKean Point. The symmetrical basal notch is 3mm deep with a 9mm opening. The basal width is 14mm, this is also the maximum width for the point. The maximum thickness of 5mm is attained 12mm above the base, or at the approximated midpoint of the object. The length of the point is 25mm. The overall flaking pattern consists of irregular bifacial retouch while the marginal retouch is well patterned. In comparison to other McKean points recovered from the site, this point is the most well formed.

DlPb-2:5149; Ring 34g; Unit 15:72N 32E; Level 4:18BS

The object consists of a complete lanceolate basally notched silicified volcanic ash McKean Point. The asymmetrical basal notch is 5mm deep with a 8mm opening. The basal width is 17mm. The point has a maximum width of 19mm located 11mm above the base; ie. approximately 1/3 of the way up the point. The maximum thickness, located in the same spot, is 6mm. The point is 35mm in length. Both the overall and marginal flaking pattern consists of random shallow bifacial retouch.

DlPb-2:5150; Ring 34g; Unit 1; Level 2:5-10BS

The object consists of a complete lanceolate basally notched silicified volcanic ash McKean Point. The asymmetrical basal notch is 4.5mm deep with a 10mm opening. The basal width is 15mm. The maximum width of 16mm is attained 17mm above the base; ie. approximately 1/2 way up the body of the point. The point is 5mm thick for most of its 32mm length. The point is twisted such that the lateral edges are not directly opposed; one edge is parallel to the ventral surface and one to the dorsal surface. The overall flaking pattern consists of bifacial random retouch while the edges display irregular retouch.

DlPb-2:5279; Ring 34g; Unit 5:60N 90E; Level 3:14BS

The object consists of the tip and most of the body of a lanceolate silicified volcanic ash McKean point. Although the base is lacking, the material type and overall morphology of the fragment suggest this object represents a portion of a McKean point. Although the original dimensions of the point can not be determined, it is estimated that the point was approximately 35mm long and 20mm wide, with a maximum thickness of approximately 5mm. The overall and marginal flaking pattern consists of random retouch.

DlPb-2:5160; Ring 33h; Unit 20:32N91E; Level3:13.5BS

The object consists of a nearly complete symmetrical triangular Montana chert Hanna point. It has a stem length of 11mm, a shoulder width of 25mm, a neck width of 19mm, a basal width of 23mm, a maximum basal thickness of 6mm, a notch height of 7mm, and a notch depth of 3mm. The maximum body thickness of 9mm arises just above the shoulder. The estimated height of the point is between 45 and 50mm (measured height minus the tip is 40mm). On one face, the overall flaking pattern is slightly irregular and the marginal flaking pattern random; due to the overall flaking only isolated instances of edge retouch were required. On the other face, the overall flaking pattern is irregular while the edges display well patterned retouch. This point displays a high level of workmanship.

DlPb-2:5158; Ring 4f; Unit 2:73N 33E; Level 3:15BS

The object consists of an asymmetrical triangular brown chalcedony Pelican Lake point. The lack of inclusions suggests this point is not made of Knife River Flint. The point has a stem length of 5mm, a shoulder width of 17mm, a neck width of 9mm, a basal width of 11mm, a maximum basal thickness of 2mm, and a notch depth of 3 & 5mm. The point attains a maximum thickness of 4mm just above the shoulders, and has a base to tip length of 27mm. The overall flaking pattern consists of unifacial irregular retouch, while the edges display bifacial irregular retouch.

DlPb-2:5161; Ring 33c; Unit 3; Level 2:5-10BS

The object consists of an asymmetrical triangular petrified wood Pelican Lake point. The point has a stem length of 5mm, a shoulder width of 15mm, a neck width of 10mm, a basal width of 11mm, a maximum basal thickness of 4mm, and a notch depth of 3 & 4mm. The point attains a maximum thickness of 5mm at the shoulder. As the tip is missing, the estimated length of the point 25 to 30mm. Both the overall and marginal flaking pattern consists of bifacial irregular retouch.

DlPb-2:5157; Ring 321; Unit 8; Level 4:15-20BS
The object consists of a symmetrical triangular Swan River chert Sandy Creek point base. The point has a stem length of 7mm, a shoulder width of 16mm, a neck width of 11.5mm, a basal width of 12mm, a maximum basal thickness of 3.5mm, a notch height of 2mm, and a notch depth of 2 & 3mm. The point attains a maximum thickness of 4mm at the shoulder. Both the overall and marginal flaking patterns are difficult to determine from this fragment, but appear to be irregular.

DlPb-2:6475; Ring 4f; Unit 4; Level 3:10-15BS
The object consists of an asymmetrical triangular red chert Besant point base and partial body. The point has a stem length of 9mm, a shoulder width of 23mm, a neck width of 15mm, a basal width of 19mm, a maximum basal thickness of 4mm, a notch height of 4mm, and a notch depth of 4 & 5mm. The point attains a maximum thickness of 6mm just above the shoulder. Both notches and the basal edge have been ground. Both the overall and marginal flaking pattern, aside from the basal edge, is bifacial irregular. The basal edge displays well patterned

retouch on one face, and irregular retouch on the other.

DlPb-2:7390; Ring 4f; Unit 14; Level 3:10-15BS
The object consists of a Knife River Flint Besant point base. The point has a stem length of 10mm, a shoulder width of approximately 19+mm, a neck width of 16mm, a basal width of 21mm, a maximum basal thickness of 4mm, a notch height of 5 & 6mm, and a notch depth of 3mm. Both notches and the basal edge have been ground. The basal edge displays well patterned retouch on one face, and irregular retouch on the other.

DlPb-2:7423; Ring 4f; Unit 14; Level 4:15-20BS
The object consists of a partial Knife River Flint Besant point base. The point has a stem length of 8mm, a shoulder width of 16mm, a neck width of ca.13mm, basal width is indeterminate, a maximum basal thickness of 3mm, a notch height of 5mm (1 notch destroyed), and a notch depth of 2mm. The remaining basal notch and portion of base are ground. What's left of the basal edge displays well patterned retouch on one face, and irregular retouch on the other. The morphology of this point base is almost identical to 7390 scaled down to a smaller size.

DlPb-2:7766; Ring 4i; Unit 3; Level 3:10-15BS
The object consists of a nearly complete symmetrical triangular Avonlea chert point. The point has a stem length of 4mm, a shoulder width of 10mm, a neck

width of 8mm, a basal width of 12mm, a maximum basal thickness of 1mm, a notch height of 2mm, and a notch depth of 1mm. The maximum body thickness of 3mm is attained across the shoulders. The maximum point width is attained across the base, and the point length is approximately 20mm. Both the overall and marginal flaking pattern is bifacial irregular.

DlPb-2:7664; Ring 4h; Unit 4:5N 6E; Level 2:8BS

The object consists of a complete symmetrical Old Women's Phase Knife River Flint point. The point has a stem length of 6mm, a shoulder width of 9.5mm, a neck width of 7mm, a basal width of 10mm, a maximum basal thickness of 2mm, a notch height of 3mm, and a notch depth of 1 & 2mm. The maximum body thickness is 2mm, the maximum width is along the base, and the point length is 18mm. The overall flaking pattern is unifacial random, while the marginal flaking pattern is bifacial irregular.

DlPb-2:8053; Ring 32e; Unit 4:85N 27E; Level 2:8.5BS

The object consists of a nearly complete asymmetrical Old Women's phase Montana chert point. The point has a stem length of 6mm, a shoulder width of 13mm, a neck width of 7mm, a basal width of 12mm, a maximum basal thickness of 0.5mm, a notch height of 3mm, and a notch depth of 2mm. The maximum body thickness is 3mm, the maximum width is across the shoulders, and the point length is approximately 15mm. The overall flaking pattern is bifacial irregular, while the marginal flaking pattern is bifacial well patterned. Only one notch is well preserved on this point, breakage along the base has all but eradicated the second notch.

DlPb-2:7610; Ring 4b; Unit 2; Level 5:20-25BS
The object consists of the body of a symmetrical triangular Montana chert point. It has a shoulder width of 20mm. The maximum body thickness is 3mm. The overall flaking pattern is slightly irregular and the marginal flaking pattern random; due to the overall flaking only isolated instances of edge retouch were required. This point displays a fairly high level of workmanship. Its morphology suggests that it belongs to either the Besant or Pelican Lake phases but the lack of the base precludes exact placement.

DlPb-2:7632; Ring 4b; Unit 4; Level 2:5-10BS
The object consists of the body of a symmetrical very fine grained quartzite point. It is 14mm X 12mm X 2mm in size. The point is made from a flake and displays well patterned marginal retouch. The lack of diagnostic attributes precludes typological classification of this point, although the overall size and morphology suggest a Late Prehistoric classification.

DlPb-2:6676; Ring 34i; Unit 3:77N 65E; Level 4:20BS
The object consists of an asymmetrical mudstone indeterminate point. Although the morphology of this point does not allow for exact typological classification, the base does bear similarities to Duncan and Hanna point bases. However, Forbis (1988

pers. comm.) suggests it may be either a Pelican Lake or Besant variant. In general, this point does not fit well within described point types. The point has a maximum length of 29mm, a maximum width of 20mm at the shoulder, with a maximum thickness of 6mm attained just below the shoulder. Both the overall and marginal flaking pattern consists of bifacial random retouch. The basal notch has been ground.

DlPb-2:7652; Ring 33i; Unit 4; Level 4:15-20BS

The object consists of the tip of an asymmetrical Montana chert point. It is 13mm X 13mm X 2mm in size. The point is made from a flake and displays well patterned marginal retouch. The lack of diagnostic attributes precludes typological classification of this point.

DlPb-2:6702; Ring 34i; Unit 2; Level 3:10-15BS

The object consists of the body of an asymmetrical chert point. It is 13mm X 14mm X 3mm in size. Both the overall and marginal flaking patterns are bifacial random. The lack of diagnostic attributes precludes typological classification of this point.

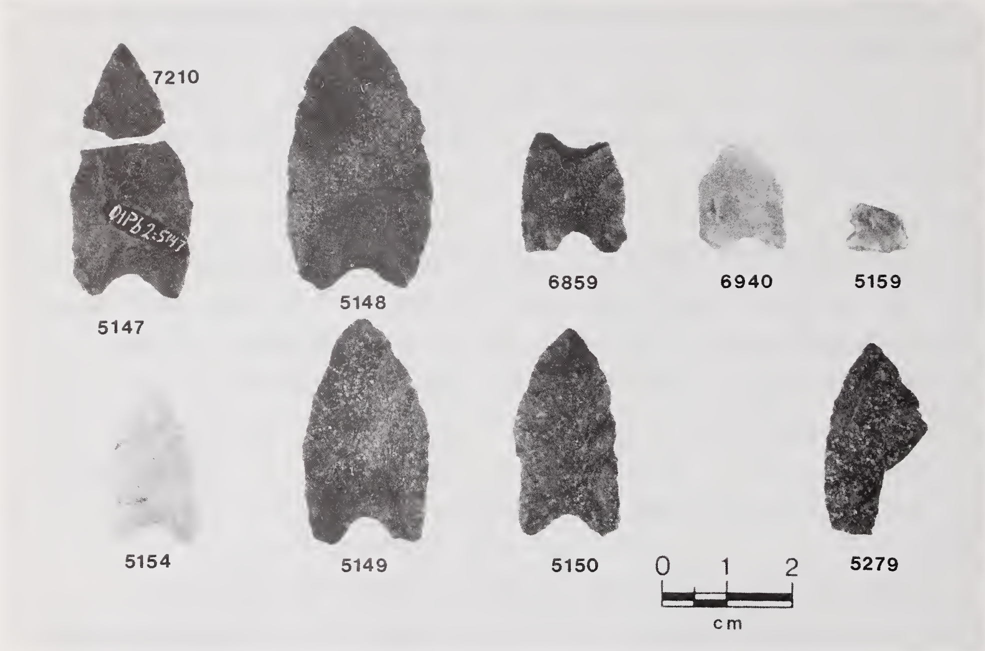

Plate 9 Projectile points recovered from DlPb-2.

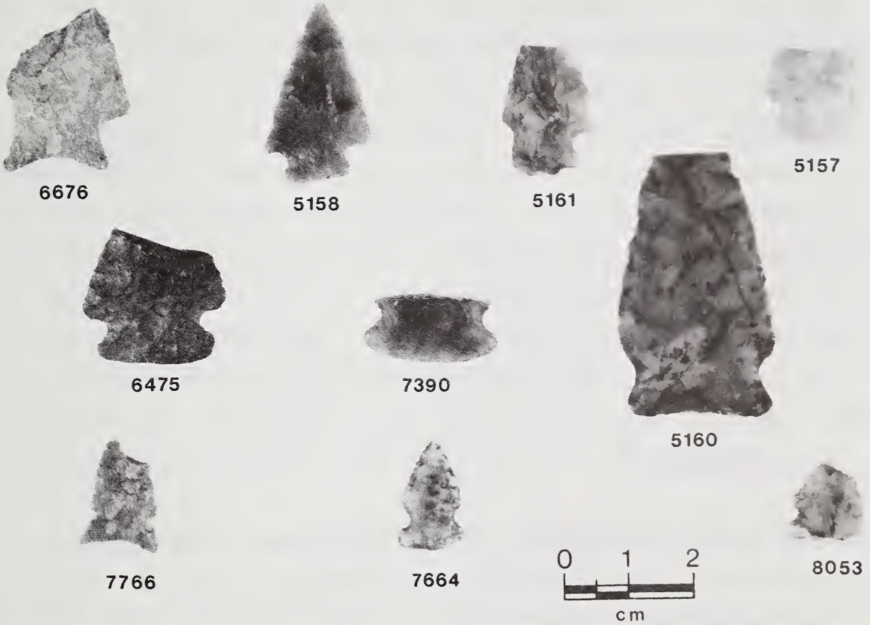

Plate 10 Projectile points recovered from DlPb-2.

BIFACES (Plate 11:8184; Plate 12:7962)

Biface is a generic term for any well made (ie. the preform is extensively modified) artifact that is flaked on both the dorsal and ventral surfaces. Bifaces can vary considerably in shape from rectangular to triangular, elliptical, lanceolate, diamond-shaped, discoidal or bipointed. In general, ovate is the most common. They may be symmetrical or asymmetrical. Bifaces could be used either as hand held or hafted tools, and were used for a variety of cutting and scraping functions.

Descriptions

DlPb-2:7419; Ring 4f; Unit 18; Level 3:10-15BS
The object consists of an obsidian biface tip. It measures 9mm X 7mm X 2mm. The original form of the biface can not be determined from this fragment. The object may have originally served as a needle or engraver. The object displays evidence leading me to suggest that the overall flaking pattern was well patterned bifacial, while the marginal flaking pattern consisted of irregular bifacial retouch.

DlPb-2:8184; Ring 4k; Unit 4:86N 70E; Level 3:14BS
The object consists of a fine grained quartzite biface fragment broken width-wise; the original length of the object cannot be determined from this fragment. It measures 59mm X 60mm X 17mm and was

likely asymmetrical ovate in original outline. The remaining working edge is approximately 128mm long. Both the overall and marginal flaking patterns are bifacial irregular.

DlPb-2:7962; Ring 32e; Unit 3:98N 74E; Level 3:12BS
The object consists of a Knife River Flint biface fragment broken width-wise. It measures 16mm X 16mm X 3mm. The outline of the object cannot be determined from this fragment, but was asymmetrical; the object comes to a point at the proximal (platform) end. The remaining working edge is approximately 37mm in length. The overall flaking pattern is bifacial irregular while marginal retouch appears to have resulted from use rather than intentional flaking.

DlPb-2:6886; Ring 33h; Unit 4:30N 44E; Level 4:16BS
The object consists of a nearly complete asymmetrical red chert biface. It measures 50mm X 28mm X 10mm and is roughly ovate in outline. Both the overall flaking pattern and the marginal flaking pattern is bifacial random; this is not a particularly well made biface.

DlPb-2:6542; Ring 34e; Unit 2:0N 23E; Level 3:11BS
The object consists of a nearly complete symmetrical triangular chert biface with a convex base. It measures 24mm X 18mm X 5mm; the maximum width is across the base. The object is made from a flake and displays well patterned marginal retouch. One large flake arising from the base was removed from

the ventral surface to facilitate hafting; the biface has not been notched. This biface could have served either as a knife or as a projectile point.

DlPb-2:7739; Ring 34h; Unit 1; Level 3:10-15BS

The object consists of a fine grained quartzite biface fragment. It measures 12mm X 10mm X 3mm. The outline of the biface cannot be determined from this object. Although only a small fragment was recovered, it appears both the overall and marginal flaking pattern was bifacial random.

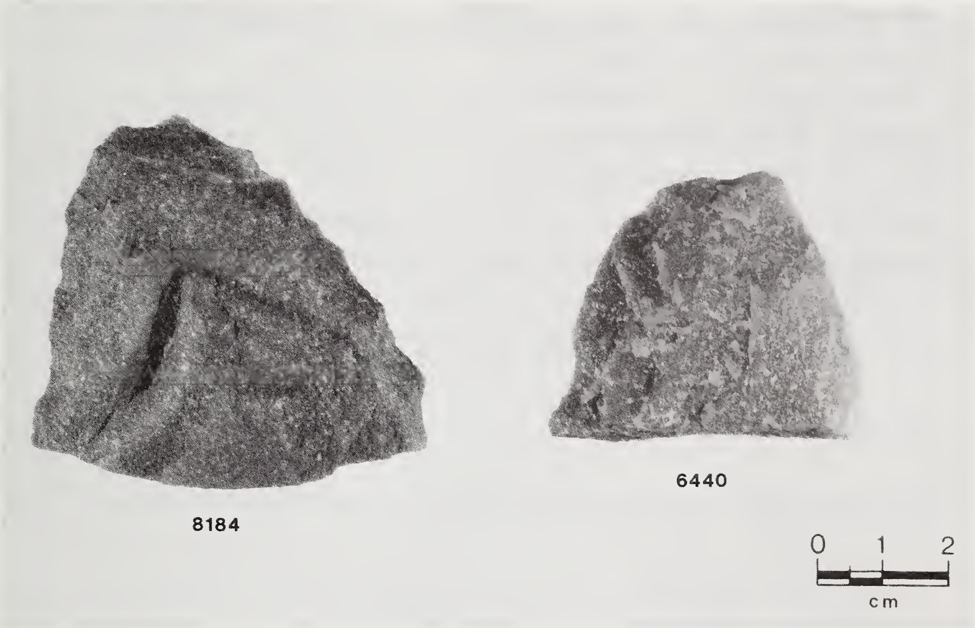

Plate 11 Biface and Uniface recovered from DlPb-2.

UNIFACES (Plate 11:6440; Plate 12:6732)

Uniface is a generic term for any well made artifact that displays overall flaking on only one of the dorsal or ventral surfaces. These objects may display bifacial marginal flaking, as in the case of DlPb-2:6440. Unifaces can vary considerably in shape from rectangular to triangular, elliptical, lanceolate, diamond-shaped, discoidal or bipointed. In general, ovate is the most common. They may be symmetrical or asymmetrical. Unifaces could be used either as hand held or hafted tools, and were used for a variety of cutting and scraping functions.

Descriptions

DlPb-2:7748; Ring 4i; Unit 1:52N 85E; Level 3:13BS
The object consists of a complete coarse grained quartzite backed cutting / chopping tool. It measures 79mm X 51mm X 16mm, and is elongated oval in outline. Both the overall and marginal flaking pattern is unifacial irregular on the ventral surface. Two flakes were removed from the left side to produce the backed edge. The dorsal surface is covered with cortex.

DlPb-2:6732; Ring 33h; Unit 8:66N 45E; Level 2:6BS
The object consists of a complete chert pointed uniface. It measures 21mm X 15mm X 3.5mm and is triangular in outline with a convex base. The overall flaking pattern is unifacial irregular while the marginal flaking pattern is unifacial well

patterned. All margins were retouched and display use wear. Use wear is also present on the ventral surface margins.

DlPb-2:6440; Ring 3b; Unit 4:99N 78E; Level 2:9BS
The object consists of a coarse grained quartzite uniface fragment broken across its width; the original length of the item cannot be determined from this fragment. It measures 41mm X 49mm X 14mm, and was probably originally symmetrical ovate in outline. The remaining working edge is approximately 101mm long. The overall flaking pattern is unifacial irregular and the marginal flaking pattern is bifacial irregular.

PIECES ESQUILLES / WEDGES (Plate 12: lower row)

Pieces Esquilles are wedges made from small flake cores or split pebbles. They were used to split long bones for marrow extraction. Pieces Esquilles and wedges recovered from the Cranford Site are summarized in Table 1.

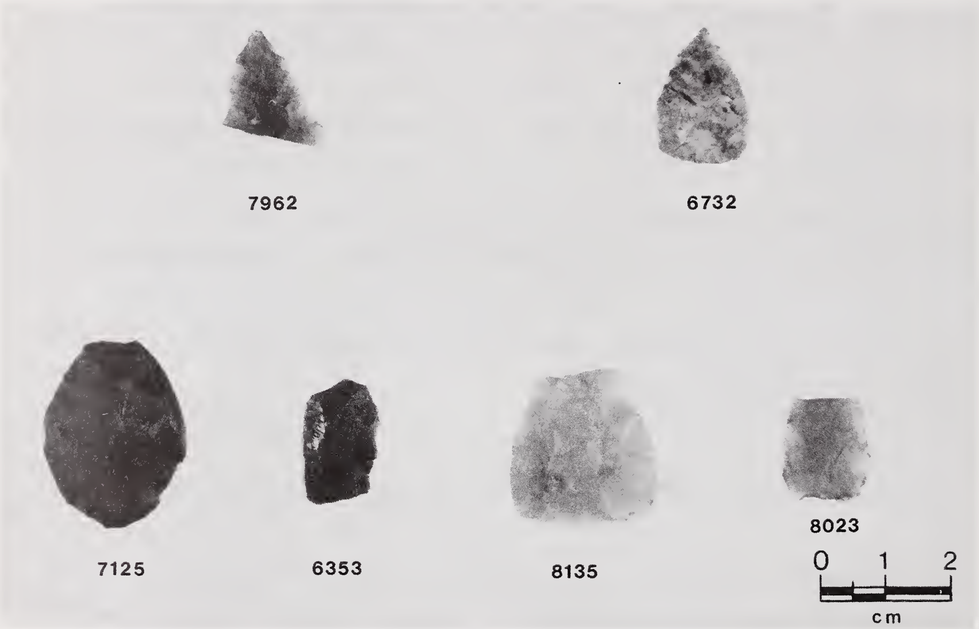

Figure 12 Biface, uniface, and wedges recovered from DlPb-2.

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PIECES ESQUILLES / WEDGES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	CHARACTER OF RETOUCH	COMPLETE / INCOMPLETE	COMMENTS
DlPb-2:6638	Chert	Ring 4b; Unit 8: 42N 5E; 18cmBS	39mm	32mm	18mm	Bifacial	Complete	Wedge
DlPb-2:8135	Swan River Chert	Ring 4j; Unit 2: Level 5; 20-25cmBS	29mm	23mm	8mm	Bifacial	Incomplete	
DlPb-2:8023	Chalcedony	Ring 32e; Unit 3: 36N 12E; 10cmBS	16mm	14mm	4mm	Bifacial	Incomplete	
DlPb-2:6353	Chert	Ring 32l; Unit 6: 47N 52E; 23cmBS	19mm	12mm	5.5mm	Bifacial	Complete	Wedge
DlPb-2:7125	Pebble Chert	Ring 33h; Unit 25: 27N 60E; 27cmBs	29.5mm	23mm	6mm	Unifacial	Complete	Bipolar split pebble with colateral flaking on dorsal surface.
DlPb-2:5121	Fine Grained Quartzite	Ring 34g; Unit 16: 55N 46E; 14cmBS	45mm	35mm	13mm	Bifacial	Complete	Wedge

Table 1 Basic Analytical Data, Pieces Esquilles/Wedges

CHOPPING TOOLS

Chopping tools are generally made from large coarse grained quartzite cobbles. They may be either bifacially or unifacially flaked. The working edge is usually produced by removing a few large flakes from the distal end; the amount of work required to produce a chopper is fairly minimal, hence they are often referred to as "crude" tools. "Finer" quality chopping tools may also be made from core fragments. These choppers tend to be smaller and made of better quality material than those described above. Chopping tools recovered from the 1987 excavation at the Cranford Site are summarized in Table 2.

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CHOPPING TOOLS

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS			PREFORM TYPE	COMMENTS
			MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS		
DlPb-2:7605	Fine Grained Quartzite	Ring 4b; Unit 1: 95N 56E; 27cmBS	95mm	58mm	50mm	Core	
DlPb-2:6053	Very Fine Grained Quartzite	Ring 4g; Unit 10: 80N 50E; 20cmBS	111mm	75mm	44mm	Core	
DlPb-2:6054	Chert Cobble	Ring 4g; Unit 9: 55N 57E; 20cmBS	82mm	63mm	51mm	Core	
DlPb-2:5848	Coarse Grained Quartzite	Ring 4g; Unit 10: 58N 40E; 23cmBS	165mm	160mm	76mm	Cobble	
DlPb-2:7793	Coarse Grained Quartzite	Ring 4i; Unit 2: 100N 75E; 10cmBS	111mm	89mm	60mm	Cobble	
DlPb-2:7792	Coarse Grained Quartzite	Ring 4i; Unit 2: 25N 35E: 10cmBS	83mm	67mm	34mm	Flake	
DlPb-2:8138	Argillite	Ring 4j; Level 5; 20-25cmBS	82mm	63mm	15mm	Cobble	
DlPb-2:7708	Coarse Grained Quartzite	Ring 4k; Unit 4: Level 2; 5-10cmBS	205mm	165mm	90mm	Cobble	
DlPb-2:6324	Fine Grained Quartzite	Ring 321; Unit 16: 48N 16E; 14cmBS	102mm	95mm	65mm	Cobble	
DlPb-2:6315	Chert	Ring 321; Unit 19: Level 3; 10-15cmBS	27mm	17mm	10mm	Pebble	Fragment
DlPb-2:7821	Fine Grained Quartzite	Ring 33d; Unit 7: 21N 45E; 18cmBS	93mm	71mm	29mm	Core	
DlPb-2:7536	Quartz	Ring 33f; Unit 3: NW¼; Level 5;	113mm	83mm	37mm	Flake	
DlPb-2:7586	Fine Grained Quartzite	Ring 33f; Unit 4: Level 3; 10-15cmBS	85mm	80mm	30mm	Cobble	
DlPb-2:6883	Coarse Grained Quartzite	Ring 33h; Unit 16: NE¼; Level 4; 20cmBS	126mm	114mm	50mm	Cobble	
DlPb-2:6957	Fine Grained Quartzite	Ring 33h; Unit 8: 2N 3E; 14cmBS	60mm	78mm	19mm	Cobble	
DlPb-2:6378	Coarse Grained Quartzite	Ring 33i; Unit 2: 84N 17E; 23cmBS	115mm	94mm	39mm	Core	
DlPb-2:7654	Coarse Grained Quartzite	Ring 33i; Unit 4: 75N 14E; 19cmBS	117mm	97mm	39mm	Core	
DlPb-2:5133	Fine Grained Quartzite	Ring 34g; Unit 2: 28-36N 87-94E; 8cmBS	85mm	87mm	34mm	Cobble	
DlPb-2:5246	Argillite	Ring 34g; Unit 2: 26N 82E; 14cmBS	68mm	75mm	17mm	Cobble	
DlPb-2:5390	Silicified Siltstone	Ring 34g; Unit 7: 85N 40E; 7cmBS	92mm	117mm	60mm	Cobble	
DlPb-2:5477	Fine Grained Quartzite	Ring 34g; Unit 13: 76N 07E; 22cmBS	94mm	60mm	37mm	Flake	
DlPb-2:7741	Fine Grained Quartzite	Ring 34h; Unit 4: 60N 15E; 14cmBS	90mm	64mm	49mm	Cobble	

Table 2 Basic Analytical Data, Chopping Tools

SCRAPERS (Plate 13)

Endscrapers are unifacially flaked tools displaying a steeply angled transverse working edge produced by concentrating secondary retouch on the distal end of a split pebble or flake. Sidescrapers are differentiated from endscrapers in that the retouch is located on one or both lateral sides. End/sidescrapers are a combination of the two forms, ie. the retouch is located on the distal end as well as one or both lateral sides. Scrapers retouched on the proximal end are rare. ‘Classic’ endscrapers generally have a triangular or "thumbnail" shape and were used as either hand held or hafted tools. Scrapers produced from split pebble blanks may also show this classic form, although their form is more dependent on the shape of the pebble from which they were produced than is the shape of a scraper produced from a flake preform.

The most common use for endscrapers was for hide working, although they may also have been used for scraping the fleshy side of skins, as well as for wood working and gouging marrow from split bones. Scrapers recovered from the Cranford Site are summarized in Table 3.

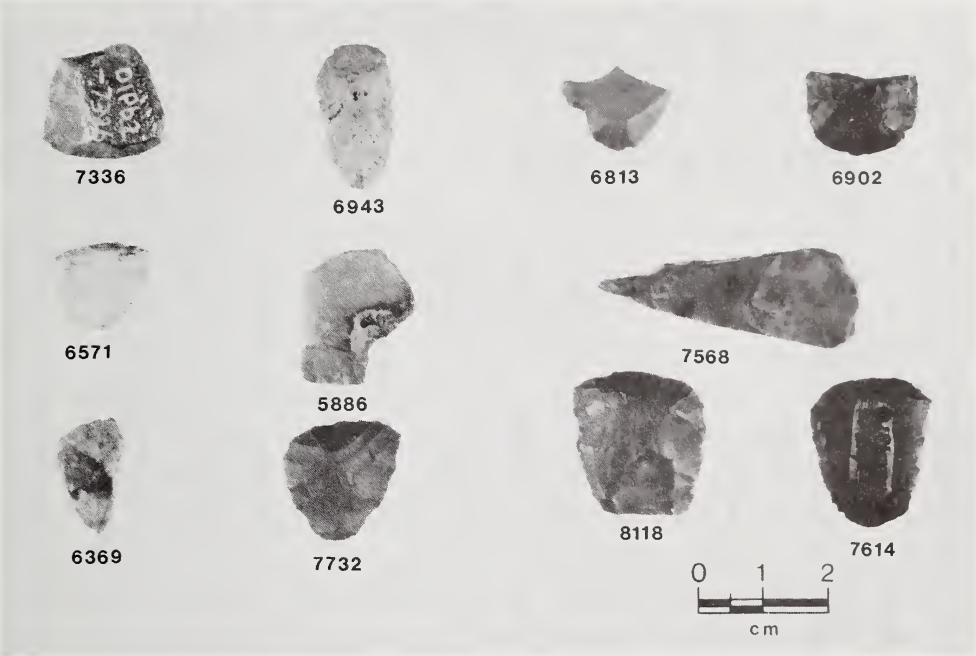

Plate 13 Scrappers recovered from DlPb-2.

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SCRAPERS

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	TYPE	NO. OF RETOUCHED EDGES	MAIN WORKING EDGE	HEIGHT OF MAIN WORKING EDGE	HAFTED	COMMENTS
DlPb-2:7614	Pebble Chert	Ring 4b; Unit 1: 62N 10E; 14cmBS	23mm	19mm	4mm	End/Side	3	Distal	4mm	No	Split Pebble
DlPb-2:6571	Avon Chert	Ring 4g; Unit 2: Level 3; 10-15cmBS	14mm	16mm	4mm	End	1	Distal	5mm	No	Lateral edges display use wear.
DlPb-2:5886	Pebble Chert	Ring 4g; Unit 3: Level 7; 30-35cmBS	21mm	19mm	6mm	End	2	Distal	2.5mm	No	Unusual shape due to material.
DlPb-2:8118	Chert	Ring 33a; Unit 3: Level 2; 5-10cmBS	23mm	21mm	8mm	End	3	Distal	7mm	Yes	
DlPb-2:7556	Chert	Ring 33f; Unit 2: Level 3; 10-15cmBS	23mm	17mm	7mm	End/Side	2	Distal	5mm	No	
DlPb-2:7568	Montana Chert	Ring 33f; Unit 2: Level 4; 15-20cmBS	41mm	16mm	4mm	End/Side	3	Distal	3mm	No	Proximal end retouched into drill.
DlPb-2:7336	Brown Chalcedony	Ring 33h; Unit 28: 85N 07E; 23cmBS	18mm	19mm	3mm	End	3	Distal	4mm	No	Heavy patination, secondary decortation flake.
DlPb-2:6902	Black Chert	Ring 33h; Unit 4: 73N 74E; 13cmBS	13mm	18mm	4mm	End/Side	3 or more	?		?	Fragment; very heavily worked.
DlPb-2:6943	Chert	Ring 33h; Unit 10:	23mm	12mm	3mm	End/Side	2	Distal/ Right	7.5mm	No	Left lateral edge displays use wear.
DlPb-2:6813	Chert	Ring 33h; Unit 15: 0-50N 0-50E; 17-18cmBS	14mm	17mm	4mm	End	2 or more	Distal	6mm	?	Fragment.
DlPb-2:6730	Chalcedony	Ring 33h; Unit 8: Level 2; 5-10cmBS	26mm	20mm	8mm	End/Side	2	Distal	10mm	-	Broken
DlPb-2:6369	Chalcedony	Ring 33i; Unit 1: Level 3; 10-15cmBS	17mm	10mm	6mm	End/Side	2	Distal/ Left	10/6mm	No	
DlPb-2:6536	Chert	Ring 34c; Unit 1: 86N 20E; 6cmBS	30mm	21mm	5mm	End/Side	3	Distal/ Right	7/10mm	No	
DlPb-2:7732	Chert	Ring 34h; Unit 1:	18mm	19mm	8mm	End/Side	2	Distal	7mm	No	

Table 3 Basic Analytical Data, Scrapers

RETOUCHED FLAKES (Plate 14)

Flakes exhibiting intentionally produced unifacial or bifacial flaking along one or more edges are termed retouched flakes. Two characteristics separate retouched flakes from formed tools. First, flaking is limited in extent and has not resulted in major alteration of the shape of the preform. Secondly, a working edge must be present; limited retouch such as associated with edge or platform preparation is not considered as representative of retouched flakes. Retouched flakes are expedient tools; they were commonly produced for a specific task, such as hide working or butchering, and then discarded. A steep working edge, ie. one similar to a scraper, likely reflects the use of the retouch flake as a scraper. Alternatively, an acutely angled working edge likely reflects use as a knife. Retouched flakes recovered from the Cranford Site are summarized in Table 4.

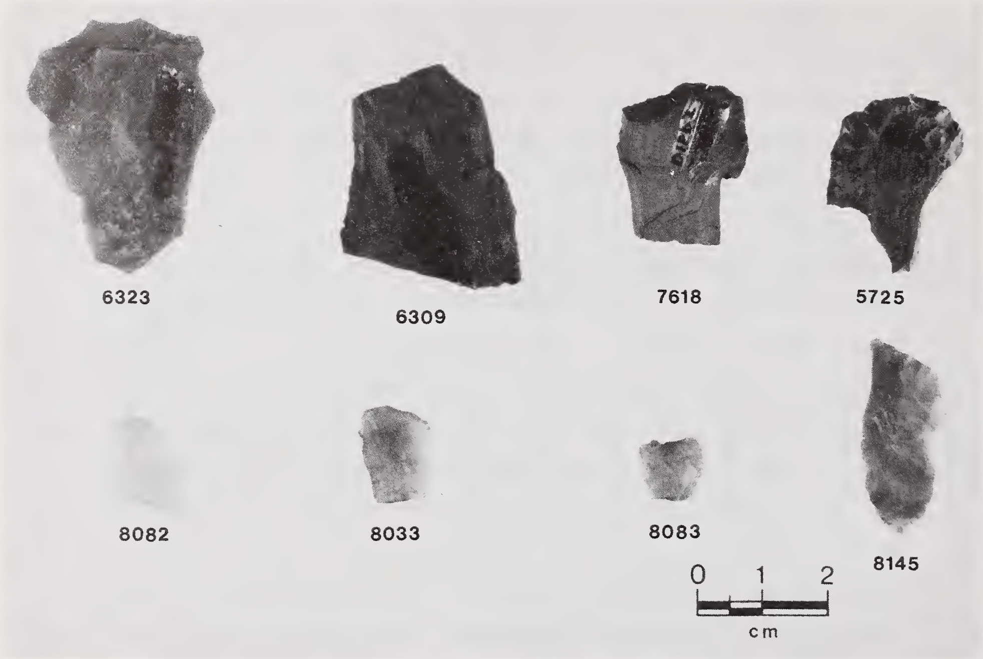

Plate 14 Retouched flakes recovered from DlPb-2.

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RETOUCHED FLAKES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS			CHARACTER OF RETOUCH	NO. OF RETOUCHED EDGES	USE WEAR	PROBABLE USE	COMMENTS
			MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS					
DlPb-2:7714	Fine Grained Quartzite	Ring 3d; Unit 3: 65N 0E; 6cmBS	60mm	74mm	14mm	Unifacial	2	Present	Chopping & Scraping	
DlPb-2:7618	Silicified Siltstone	Ring 4b; Unit 2: Level 2: 5-10cmBS	25mm	20mm	5mm	Unifacial	2	Present	Scraping	
DlPb-2:7635	Chert	Ring 4b; Unit 3: 1N 60E; 25cmBS	22mm	15mm	4mm	Unifacial	1	Present	Scraping	
DlPb-2:7606	Argillite	Ring 4b; Unit 1: Level 7; 30-35cmBS	43mm	40mm	7mm	Unifacial	1	Present	Scraping	
DlPb-2:7607	Very Fine Grained Quartzite	Ring 4b; Unit 2: 33N 67E; 27cmBS	28mm	22mm	9mm	Unifacial	1	Present	Scraping	
DlPb-2:7421	Brown Chalcedony	Ring 4f; Unit 14: Level 4; 15-20cmBS	30mm	25mm	4mm	Bifacial	2	Present	Cutting	Core Fragment
DlPb-2:7393	Fine Grained Quartzite	Ring 4f; Unit 16: 93N 44E; 12cmBS	66mm	49mm	31mm	Unifacial	All (4)	Absent	-	Marginally retouched split cobble.
DlPb-2:7370	Chert	Ring 4f; Unit 14: 32N 56E; 12cmBS	40mm	16mm	7mm	Unifacial	2	Present	Cutting & Scraping	
DlPb-2:5725	Petrified Wood	Ring 4g; Unit 2: 37N 76E; 23cmBS	27mm	21mm	8mm	Unifacial	2	Present	Cutting & Scraping	
DlPb-2:5853	Fine Grained Quartzite	Ring 4g; Unit 2: 96N 39E; 32cmBS	50mm	43mm	20mm	Unifacial	1	Present	Cutting	Core Fragment
DlPb-2:6011	Chert	Ring 4g; Unit 10: 60N 38E; 29cmBS	65mm	35mm	13mm	Unifacial	1	Present	Cutting	
DlPb-2:7136	Petrified Wood	Ring 33h; Unit 26: 98N 59E; 28cmBs	35mm	28mm	4mm	Unifacial & Bifacial	3	Present	Cutting & Scraping	
DlPb-2:7333	Very Fine Grained Quartzite	Ring 33h; Unit 18: Level 3; 10-15cmBS	60mm	41mm	13mm	Unifacial	4	Present	Cutting & Scraping	
DlPb-2:7242	Silicified Siltstone	Ring 33h; Unit 19: Level 5; 20-25cmBS	27mm	23mm	3mm	Unifacial	1	Present	Cutting	
DlPb-2:7281	Very Fine Grained Quartzite	Ring 33h; Unit 18: Level 5; 20-25cmBS	25mm	18mm	7mm	Unifacial	2	Present	Cutting	
DlPb-2:7260	Chert	Ring 33h; Unit 18: 80N 92E; 25cmBS	39mm	25mm	13mm	Unifacial	3	Present	Cutting & Scraping	
DlPb-2:7359	Brown Chalcedony	Ring 33h; Unit 27: Level 3; 10-15cmBS	16mm	16mm	2mm	Bifacial	2	Present	Cutting	

Table 4 Basic Analytical Data, Retouched Flakes

02

RETOUCHED FLAKES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS			CHARACTER OF RETOUCH	NO. OF RETOUCHED EDGES	USE WEAR	PROBABLE USE	COMMENTS
			MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS					
DlPb-2:5902	Coarse Grained Quartzite	Ring 4g; Unit 11: 73N 96E; 8cmBS	78mm	99mm	32mm	Unifacial	1	Present	Chopping	
DlPb-2:5634	Fine Grained Quartzite	Ring 4g; Unit 1: 54N 66E; 27cmBS	64mm	39mm	21mm	Unifacial	2	Present	Scraping	Core Fragment
DlPb-2:5551	Silicified Siltstone	Ring 4g; Unit 14: Level 5; 20-25cmBS	22mm	18mm	2mm	Unifacial/ Bifacial	2	Present	Cutting	
DlPb-2:5702	Petrified Wood	Ring 4g; Unit 2: 48N 73E; 24cmBS	21mm	17mm	9mm	Unifacial	1	Present	Scraping	
DlPb-2:5847	Very Coarse Grained Quartzite	Ring 4g; Unit 2: 90N 92E; 35cmBS	78mm	65mm	14mm	Unifcial	1	Present	Scraping	
DlPb-2:6058	Montana Chert	Ring 4g; Unit 10: Level 4; 15-20cmBS	18mm	13mm	3mm	Unifacial	1	Present	Cutting	
DlPb-2:6062	Avon Chert	Ring 4g; Unit 10: 37N 53E; 33cmBS	15mm	14mm	3mm	Unifacial	1	Present	Cutting	One utilized cutting edge as well
DlPb-2:6596	Chert	Ring 4j; Unit 3: Level 5; 20-25cmBS	40mm	27mm	5mm	Unifacial	1	Present	Cutting	
DlPb-2:8144	Coarse Grained Quartzite	Ring 4j; Unit 3: Level 3; 10-15cmBS	45mm	59mm	10mm	Unifacial	1	Present	Scraping	
DlPb-2:8145	Knife River Flint	Ring 4j; Unit 3: Level 4; 15-20cmBS	30mm	13mm	3mm	Unifacial	1	Present	Scraping	
DlPb-2:7699	Petrified Wood	Ring 4k; Unit 4: Level 3; 10-15cmBS	55mm	24mm	7mm	Bifacial	1	Present	Cutting	
DlPb-2:7911	Fine Grained Quartzite	Ring 32e; Unit 6: 70N 88E; 11cmBS	43mm	31mm	10mm	Unifacial	1	Present	Scraping	
DlPb-2:6316	Pebble Chert	Ring 32e; Unit 15: Level 1; 0-5cmBS	22mm	12mm	3mm	Unifacial	1	Present	Scraping	
DlPb-2:7919	Brown Chalcedony	Ring 32e; Unit 6: Level 3; 10-15cmBS	20mm	15mm	6mm	Unifacial	2	Present	Cutting & Scraping	
DlPb-2:8026	Grey Chert	Ring 32e; Unit 3: 26N 98E; 9cmBs	22mm	13mm	3mm	Unifacial & Bifacial	4	Present	Cutting & Scraping	
DlPb-2:8066	Brown Chalcedony	Ring 32e; Unit 4: Level 2: 9cmBS	12mm	9mm	2mm	Bifacial	2	Present	Cutting	Broken off a larger flake

Table 4 Basic Analytical Data, Retouched Flakes (continued)

03

RETOUCHED FLAKES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	CHARACTER OF RETOUCH	NO. OF RETOUCHED EDGES	USE WEAR	PROBABLE USE	COMMENTS
DlPb-2:8033	Knife River Flint	Ring 32e; Unit 3: 37N 81E; 8cmBS	15mm	11mm	4mm	Bifacial	3	Present	Cutting & Scraping	
DlPb-2:8083	Knife River Flint	Ring 32e; Unit 7: 5 - 10cmBS	10mm	10mm	2.5mm	Unifacial	2	Present	Cutting	Distal end broke off during use
DlPb-2:8082	Opalescent White Chert	Ring 32e; Unit 7; Level 2: 5-10cmBS	15mm	11mm	3mm	Unifacial	1	Present	Cutting	
DlPb-2:8065	Brown Chalcedony	Ring 32e; Unit 4: Level 2; 9cmBS	17mm	16mm	3mm	Unifacial	1	Present	Cutting	
DlPb-2:8011	Heat Treated Chert	Ring 32e; Unit 5: Level 4; 15-20cmBS	22mm	13mm	4mm	Bifacial	1	Present	Cutting	
DlPb-2:7691	Obsidian	Ring 32l; Unit 19; 12N 88E; 24cmBS	10mm	13mm	1mm	Unifacial	2	Present	Cutting	
DlPb-2:6309	Very Fine Grained Quartzite	Ring 32l; Unit 20: 100N 25E; 8cmBS	36mm	29mm	7mm	Unifacial & Bifacial	3	Present	Cutting	
DlPb-2:6724	Obsidian	Ring 33h; Unit 4: Level 1; 0-5cmBS	13mm	11mm	3mm	Unifacial	1	Present	Scraping	
DlPb-2:6839	Coarse Grained Quartzite	Ring 33h; Unit 15: 79N 9E; 10cmBS	93mm	81mm	44mm	Unifacial	1	Present	Scraping	
DlPb-2:6967	Chert	Ring 33h; Unit 5: Level 3; 10-15cmBS	17mm	16mm	4mm	Unifacial	1	Present	Cutting	
DlPb-2:7108	Petrified Wood	Ring 33h; Unit 28: Level 3; 10-15cmBS	36mm	34mm	9mm	Unifacial	1	Present	Cutting	
DlPb-2:7122	Chert	Ring 33h; Unit 33: Level 6; 25-30cmBS	20mm	17mm	10mm	Unifacial	1	Present	Scraping	One utilized (cutting) edge as well
DlPb-2:6361	Schist	Ring 33h; Unit 3: 15N 30E; Level 4; 15-20cmBS	113mm	74mm	12mm	Unifacial	3	Present	Scraping	
DlPb-2:6376	Very Coarse Grained Quartzite	Ring 33i; Unit 2: 12N 77E; 12cmBS	148mm	94mm	13mm	Unifacial/ Bifacial	2	Present	Chopping	
DlPb-2:6377	Chert	Ring 33i; Unit 2: 17N 85E; 25cmBS	40mm	26mm	9mm	Unifacial	1	Present	Cutting	

Table 4 Basic Analytical Data, Retouched Flakes (continued)

04

RETOUCHED FLAKES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	CHARACTER OF RETOUCH	NO. OF RETOUCHED EDGES	USE WEAR	PROBABLE USE	COMMENTS
DlPb-2:6323	Fine Grained Quartzite	Ring 321; Unit 20: 43N 53E; 18cmBS	40mm	30mm	8mm	Unifacial	2	Present	Cutting &	
DlPb-2:6329	Montana Chert	Ring 321; Unit 14; Level 3: 10-15cmBS	18mm	14mm	4mm	Unifacial	2	Present	Cutting &	
DlPb-2:7811	Very Fine Grained Quartzite	Ring 33d; Unit 8: Level 3; 10-15cmBS	34mm	14mm	8mm	Unifacial	1	Present	Cutting	
DlPb-2:7462	Obsidian	Ring 33d; Unit 4: Level 3; 10-15cmBS	30mm	9.5mm	5.5mm	Unifacial	1	Present	Cutting	
DlPb-2:7723	Chert	Ring 33d; Unit 3: Level 2; 5-10cmBS	35mm	23mm	4mm	Unifacial	2	Present	Scraping	
DlPb-2:6530	Obsidian	Ring 34b; Unit 1: Level 2; 5cmBS	12mm	12mm	1mm	Unifacial	1	Present	Cutting	
DlPb-2:6525	Coarse Grained Quartzite	Ring 34b; Unit 1: 60N 45E; 7cmBS	68mm	53mm	17mm	Unifacial	2	Present	Cutting & Scraping	
DlPb-2:6528	Petrified Wood	Ring 34b; Unit 1: Level 2; 5-10cmBS	45mm	19mm	8mm	Unifacial	1	Present	Cutting	
DlPb-2:6558	Chert	Ring 34d; Unit 4: 22N 43; 9cmBS	22mm	21mm	6.5mm	Unifacial	1	Present	Scraping	
DlPb-2:5406	Chert	Ring 34g; Unit 20: 58N 100E; 13cmBS	22mm	17mm	4mm	Unifacial	1	Present	Scraping	
DlPb-2:5331	Very Fine Grained Quartzite	Ring 34g; Unit 8: 0N 38E; 15cmBS	43mm	30mm	14mm	Bifacial	3	Present	Cutting	
DlPb-2:5120	White Chert	Ring 34g; Unit 14: Level 2; 5-10cmBS	20mm	20mm	3mm	Unifacial	2	Present	Scraping	
DlPb-2:5130	Coarse Grained Quartzite	Ring 34g; Unit 2: 59N 40E; 7cmBS	40mm	38mm	10mm	Unifacial	1	Present	Scraping	
DlPb-2:5144	Coarse Grained Quartzite	Ring 34g; Unit 3: 23N 18E; 11cmBS	65mm	44mm	20mm	Unifacial	2	Present	Scraping	
DlPb-2:5221	Chert	Ring 34g; Unit 6: 9N 69E; 13cmBS	23mm	12mm	2.5mm	Bifacial	1	Present	Cutting	
DlPb-2:5356	Fine Grained Quartzite	Ring 34g; Unit 8: 83N 50E; 14cmBS	43mm	38mm	6mm	Bifacial	3	Present	Cutting	
DlPb-2:6679	Fine Grained Quartzite	Ring 34i; Unit 3: 100N 89E; 17cmBS	43mm	30mm	14mm	Unifacial	2	Present	Scraping	

Table 4 Basic Analytical Data, Retouched Flakes (continued)

05

RETOUCHED FLAKES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	CHARACTER OF RETOUCH	NO. OF RETOUCHED EDGES	USE WEAR	PROBABLE USE	COMMENTS
DlPb-2:7653	Very Coarse Grained Quartzite	Ring 33i; Unit 4: 38N 40E; 20cmBS	76mm	73mm	19mm	Unifacial	1	Present	Chopping	
DlPb-2:6656	Obsidian	Ring 33j; Level 5; 20-25cmBs	21mm	28mm	2.5mm	Bifacial	2	Present	Cutting	
DlPb-2:7800	Silicified Volcanic Ash	Ring 33d; Unit 5: 1N 7E; 19cmBS	45mm	25mm	10mm	Unifacial	1	Present	Cutting	
DlPb-2:6420	Red Chert	Ring 33d; Unit 1: Level 3; 10-15cmBS	14mm	10mm	2mm	Unifacial	1	Present	Cutting	
DlPb-2:6425	Red Chert	Ring 33d; Unit 1: 60N 55E; 12cmBS	10mm	10mm	3mm	Unifacial	1	Present	Cutting	
DlPb-2:7851	Petrified Wood	Ring 33g; Unit 1: Level 5; 20-25cmBS	19mm	19mm	3mm	Unifacial	1	Present	Cutting	

Table 4 Basic Analytical Data, Retouched Flakes (continued)

UTILIZED FLAKES

Utilized flakes are flakes of any type that show use wear on one or more edges as represented by small flakes extending inward generally no more than 2mm from the edge. They do not display any evidence suggesting intentional retouch. Utilized flakes recovered from the Cranford Site are summarized in Table 5.

01

UTILIZED FLAKES

CATALOGUE No.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	NO. OF UTILIZED EDGES	PROBABLE USE	COMMENTS
DlPb-2:6441	Fine Grained Quartzite	Ring 3b; Unit 4: 88N 61E; 9cmBS	39mm	35mm	7mm	1	Scraping	
DlPb-2:6447	Fine Grained Quartzite	Ring 3b; Unit 3: 25N 58E; 7cmBS	27mm	13mm	6mm	1	Scraping	
DlPb-2:6455	Coarse Grained Quartzite	Ring 3b; Unit 3: 57N 58E; 8cmBS	20mm	13mm	4mm	1	Scraping	
DlPb-2:6465	Fine Grained Quartzite	Ring 3b; Unit 3: 13N 24E; 8cmBs	40mm	20mm	14mm	1	Cutting	
DlPb-2:7683	Knife River Flint	Ring 3d; Unit 1: 6N 50E; 9cmBS	22mm	24mm	4mm	1	Cutting	
DlPb-2:6626	Chert	Ring 4b; Unit 8: Level 3; 10-15cmBS	13mm	12mm	6mm	1	Cutting	
DlPb-2:5620	Brown Chalcedony	Ring 4g; Unit 8: 37N 85E; 18cmBS	15mm	12mm	1mm	1	Cutting	
DlPb-2:5617	Very Fine Grained Quartzite	Ring 4g; Unit 6: Level 4; 15-20cmBS	21mm	18mm	8mm	1	Cutting	
DlPb-2:6000	Black Pebble Chert	Ring 4g; Unit 11: Level 3; 10-15cmBS	18mm	26mm	4mm	1	Scraping	
DlPb-2:6032	Silicified Siltstone	Ring 4g; Unit 12: Level 6; 25-30cmBS	19mm	17mm	3mm	1	Cutting	
DlPb-2:6068	Brown Chalcedony	Ring 4g; Unit 12: Level 3; 10-15cmBS	19mm	13mm	1.5mm	1	Cutting	
DlPb-2:5777	Schist (?)	Ring 4g; Unit 1: Level 5; 20-25cmBS	148mm	102mm	50mm	1	Chopping	
DlPb-2:7394	Very Coarse Grained Quartzite	Ring 4f; Unit 14: 80N 91E; 11cmBS	85mm	107mm	19mm	3	Chopping	

Table 5 Basic Analytical Data, Utilized Flakes

02

UTILIZED FLAKES

CATALOGUE No.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	NO. OF UTILIZED EDGES	PROBABLE USE	COMMENTS
DlPb-2:6486	Brown Chalcedony	Ring 4f; Unit 2: 45N 50E; 12cmBS	25.5mm	22mm	1.5mm	2	Cutting	
DlPb-2:7430	Silicified Siltstone	Ring 4f; Unit 11: Level 2; 5-10cmBS	24mm	19mm	2mm	2	Cutting	
DlPb-2:7367	Brown Chalcedony	Ring 4f; Unit 13: Level 1(Sod)0-5cmBS	10mm	9mm	1mm	2	Cutting	
DlPb-2:7369	Brown Chalcedony	Ring 4f; Unit 14: Level 1(Sod)0-5cmBS	17mm	12mm	2mm	3	Cutting & Drilling	Distal end comes to a point.
DlPb-2:8130	Fine Grained Quartzite	Ring 4j; Unit 2: Level 5; 10-15cmBS	55mm	36mm	10mm	3	Scraping	
DlPb-2:7913	Petrified Wood	Ring 32e; Unit 5: 50N 38E; 14cmBS	42mm	21mm	5mm	2	Cutting & Scraping	
DlPb-2:7915	Black Pebble Chert	Ring 32e; Unit 5: Level 3; 10-15cmBS	21mm	16mm	7mm	1	Scraping	
DlPb-2:7924	Montana Chert	Ring 32e; Unit 4: 99N 91E; 17.5cmBS	24mm	10mm	4mm	1	Scraping	
DlPb-2:8060	Brown Chalcedony	Ring 32e; Unit 4: 31N 40E; 6cmBS	17mm	11mm	4mm	3	Cutting	
DlPb-2:6348	Chert	Ring 32l; Unit 5: 94N 08E; 14cmBS	21mm	19mm	1.5mm	1	Scraping	
DlPb-2:6072	Chert	Ring 32l; Unit 17: Level 4; 15-20cmBS	20mm	18mm	4mm	1	Scraping	
DlPb-2:6115	Fine Grained Quartzite	Ring 32l; Unit 2: 30N 22E; 19cmBS	66mm	50mm	10mm	1	Chopping	
DlPb-2:7479	White Chert	Ring 33d; Unit 3: Level 4; 15-20cmBS	19mm	19mm	3mm	1	Scraping	

Table 5 Basic Analytical Data, Utilized Flakes (continued)

03

UTILIZED FLAKES

CATALOGUE No.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	NO. OF UTILIZED EDGES	PROBABLE USE	COMMENTS
DlPb-2:7587	Coarse Grained Quartzite	Ring 33f; Unit 4: Level 3; 10-15cmBS	77mm	69mm	17mm	2	Chopping & Scraping	
DlPb-2:7844	Obsidian	Ring 33g; Unit 4: Level 3; 10-15cmBS	12mm	9mm	3mm	2	Cutting	
DlPb-2:7018	Obsidian	Ring 33h; Unit 5: Level 5; 20-25cmBS	12mm	18mm	1.5mm	1	Cutting	
DlPb-2:6888	Chert	Ring 33h; Unit 4: 30N 54E; 18cmBS	33mm	30mm	6mm	1	Cutting	
DlPb-2:7019	Pebble Chert	Ring 33h; Unit 8: Level 5; 23-25cmBS	20mm	16mm	5mm	1	Cutting	Bipolar Split Pebble
DlPb-2:7343	Chert	Ring 33h; Unit 37: Level 3; 10-15cmBS	33mm	15mm	6mm	1	Cutting	
DlPb-2:7222	Fine Grained Quartzite	Ring 33h; Unit 38: 09N 07E; 30cmBS	65mm	32mm	13mm	1	Cutting	
DlPb-2:7141	Silicified Siltstone	Ring 33h; Unit 28: 23N 07E; 19cmBS	35mm	14mm	6.5mm	1	Cutting	
DlPb-2:7237	Chert	Ring 33h; Unit 17: Level 5; 20-25cmBS	40mm	26mm	12mm	1	Cutting	
DlPb-2:6814	Silicified Siltstone	Ring 33h; Unit 15: 70-90N 80-90E; 20cmBs	15mm	12mm	3.5mm	1	Cutting	
DlPb-2:6949	Chert	Ring 33h; Unit 5: 40N 68E; 22cmBS	19mm	15mm	4mm	1	Cutting	
DlPb-2:6833	Fine Grained Quartzite	Ring 33h: Unit 14: 34N 70E; 9cmBS	94mm	72mm	25mm	2	Chopping	

Table 5 Basic Analytical Data, Utilized Flakes (continued)

04

UTILIZED FLAKES

CATALOGUE No.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	NO. OF UTILIZED EDGES	PROBABLE USE	COMMENTS
DlPb-2:6930	Fine Grained Quartzite	Ring 33h: Unit 1: 38N 20E; 8cmBS	59mm	56mm	12mm	2	Scraping	
DlPb-2:7016	Quartz Crystal	Ring 33h; Unit 8: 96N 98E; 24cmBS	41mm	44mm	11mm	1	Scraping	
DlPb-2:6363	Argillite	Ring 33i; Unit 4: Level 5; 20-25cmBS	46mm	33mm	5mm	1	Cutting	
DlPb-2:8105	Chert	Ring 33j; Unit 2: 0-50N 0-50E; 9cmBS	20mm	18mm	9mm	1	Cutting	
DlPb-2:7459	Chert	Ring 34d; Unit 2: 72N 40E; 12cmBS	33mm	25mm	8mm	2	Cutting	
DlPb-2:7457	Coarse Grained Quartzite	Ring 34d; Unit 2: 30N 74E; 12cmBS	30mm	25mm	10mm	1	Scraping	
DlPb-2:6513	Chalcedony	Ring 34f; Unit 1: Level 5; 20-25cmBS	18mm	12mm	1mm	3	Cutting	
DlPb-2:5127	Very Fine Grained Quartzite	Ring 34g; Unit 2: Level 2; 5-10cmBS	25mm	19mm	5mm	1	Cutting	
DlPb-2:5369	Obsidian	Ring 34g; Unit 8: 31N 74E; 15cmBS	8mm	7mm	1mm	1	Cutting	
DlPb-2:5355	Avon Chert	Ring 34g; Unit 8: 14N 54E; 13cmBS	25mm	17mm	3mm	1	Cutting	
DlPb-2:5409	Brown Chalcedony	Ring 34g; Unit 17: 86N 34E; 14cmBS	20mm	17mm	1.5mm	2	Cutting	
DlPb-2:5139	Black Pebble Chert	Ring 34g; Unit 2: 49N 12E; 22cmBS	24mm	18mm	8mm	1	Scraping	

Table 5 Basic Analytical Data, Utilized Flakes (continued)

05

UTILIZED FLAKES

CATALOGUE No.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS			NO. OF UTILIZED EDGES	PROBABLE USE	COMMENTS
			MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS			
DlPb-2:5145	Coarse Grained Quartzite	Ring 34g: Unit 3: 5-13N 10-19E; 7cmBS	127mm	75mm	21mm	1	Scraping	
DlPb-2:5152	Argillite	Ring 34g; Unit 1: Level 2; 5-10cmBS	56mm	32mm	10mm	1	Cutting	
DlPb-2:5185	Chert	Ring 34g; Unit 1: 25N 23E; 7cmBS	43mm	38mm	7mm	1	Cutting	
DlPb-2:5195	Silicified Volcanic Ash	Ring 34g; Unit 16: 18N 19E; 14cmBS	18mm	15mm	5mm	2	Cutting & Scraping	
DlPb-2:5214	Coarse Grained Quartzite	Ring 34g; Unit 6: 44N 22E; 13cmBS	50mm	31mm	5mm	1	Cutting	
DlPb-2:5219	Black Pebble Chert	Ring 34g; Unit 6: 43N 82E; 13cmBS	19mm	16mm	3.5mm	1	Cutting	
DlPb-2:5225	Silicified Volcanic Ash	Ring 34g; Unit 6: 54N 73E; 15cmBS	19mm	13mm	2.5mm	2	Cutting	
DlPb-2:5251	Pebble Chert	Ring 34g; Unit 2: 29N 50E; 11cmBS	18mm	18mm	3mm	1	Scraping	
DlPb-2:5264	Chert	Ring 34g; Unit 16: Level 4; 15-20cmBS	16mm	13mm	3mm	2	Scraping	
DlPb-2:5414	Chert	Ring 34g; Unit 9: 43N 94E; 9cmBS	24mm	30mm	8mm	2	Cutting & Scraping	
DlPb-2:5461	Obsidian	Ring 34g; Unit 13: Level 4; 15-20cmBS	9mm	12mm	1mm	1	Cutting	
DlPb-2:7731	Petrified Wood	Ring 34h; Unit 2: Level 2; 5-10cmBS	10mm	8mm	1mm	1	Cutting	

Table 5 Basic Analytical Data, Utilized Flakes (continued)

CORES

Cores are masses of material specifically intended for the production of flakes. Cores which are formed to allow detachment of a flake of specific shape and/or size, such as microblade cores, are defined as prepared cores. Unformed cores are designated as unprepared cores. Cores may be produced from unmodified nodules of raw material such as pebbles and cobbles, from mined blocks of material such as many of the Montana derived materials, or from shatter and flakes. Whole cores can be characterized by the presence of some, but not necessarily all, of the following: a form which suggests they served for the production of flakes, one or more striking platforms, negative flake scars, negative bulbs of percussion, or pressure flaking scars.

Cores are the starting point in stone tool production. Flakes derived from they may be utilized without the benefit of further work (utilized flakes), retouched to produce expedient tools (retouched flakes), or heavily worked to produce formed tools. Cores recovered from the Cranford Site are summarized in Table 6.

01

CORES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	DIMENSIONS MAX. WIDTH	DIMENSIONS MAX. THICKNESS	PREPARED UNPREPARED	POLYMORPHIC (YES/NO)	NO. OF FLAKE SCARS	EXHAUSTED (YES/NO)	COMMENTS
DlPb-2:8128	Coarse Grained Quartzite	Ring 4a; Unit 4: 78N 40E; 14cmBs	130mm	110mm	65mm	Unprepared	Yes	7	No	
DlPb-2:6482	Brown Chalcedony	Ring 4f; Unit 4: 17N 70E; 12cmBS	37mm	18mm	17mm	-	Yes	8+	Yes	Fragment
DlPb-2:5594	Chert	Ring 4g; Unit 7: 45N 5E; 14cmBS	39mm	20mm	19mm	Unprepared	Yes	9	No	
DlPb-2:5736	Chert Pebble	Ring 4g; Unit 7: Level 6; 25-30cmBS	19mm	15mm	9mm	Unprepared	Yes	11	Yes	
DlPb-2:5700	Chert	Ring 4g; Unit 2: 78N 5E; 23cmBS	24mm	18mm	7mm	-	Yes	6+	Yes	Bipolar Split Pebble
DlPb-2:5487	Very Coarse Grained Quartzite	Ring 4g; Unit 15: 15-31N 0-14E;5-12cmBS	150mm	130mm	72mm	Unprepared	Yes	2	No	Large Flake - Core
DlPb-2:5983	Very Fine Grained Quartzite	Ring 4g; Unit 11: 23N 53E; 23cmBs	40mm	39mm	19mm	Unprepared	-	4+	Fragment	
DlPb-2:6060	Coarse Grained Quartzite	Ring 4g; Unit 11: 80N 25E; 20cmBs	135mm	113mm	45mm	Unprepared	No	3	No	
DlPb-2:8074	Fine Grained Quartzite	Ring 32e; Unit 7: 9N 54E; Level 2; 5-10cmBS	88mm	55mm	30mm	Unprepared	Yes	6	No	Fragment
DlPb-2:8004	Fine Grained Quartzite	Ring 32e; Unit 8: Level 4; 15-20cmBS	83mm	70mm	50mm	Unprepared	Yes	8	No	
DlPb-2:6108	Chert	Ring 321; Unit 12: Level 5; 20-25cmBS	20mm	15mm	9mm	Unprepared	Yes	8+	Yes	
DlPb-2:5270	Fine Grained Quartzite	Ring 34g; Unit 5: 90N 73E; 14cmBS	64mm	45mm	32mm	Unprepared	Yes	5	No	Broke during reduction
DlPb-2:5327	Fine Grained Quartzite	Ring 34g; Unit 14: 38N 17E; 15cmBS	118mm	82mm	46mm	Unprepared	Yes	6	No	Split Cobble

Table 6 Basic Analytical Data, Cores

02

CORES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	PREPARED UNPREPARED	POLYMORPHIC (YES/NO)	NO. OF FLAKE SCARS	EXHAUSTED (YES/NO)	COMMENTS
DlPb-2:7521	Quartz	Ring 33d; Unit 2: 95N 62E; 17cmBs	49mm	35mm	25mm	-	-	-	Fragment	
DlPb-2:7510	Fine Grained Quartzite	Ring 33d; Unit 2: 13N 26E; 20cmBS	80mm	65mm	25mm	Unprepared	Yes	2	No	
DlPb-2:7588	Coarse Grained Quartzite	Ring 33f; Unit 4: Level 3; 10-15cmBS	124mm	115mm	62mm	Unprepared	Yes	5	No	
DlPb-2:7220	Fine Grained Quartzite	Ring 33h; Unit 23: 30N 99E; 12cmBS	110mm	100mm	90mm	Unprepared	Yes	2	No	
DlPb-2:7181	Quartz	Ring 33h; Unit 26: 87N 98E; 18cmBS	62mm	39mm	25mm	Unprepared	No	3	No	
DlPb-2:6374	Fine Grained Quartzite	Ring 33i; Unit 2: 15N 59E; 12cmBS	39mm	19mm	11mm	Unprepared	Yes	4	Yes	
DlPb-2:7649	Coarse Grained Quartzite	Ring 33i; Unit 4: 60N 25E; 20cmBS	161mm	95mm	70mm	Unprepared	No	3	No	
DlPb-2:8098	Fine Grained Quartzite	Ring 33j; Unit 3: 26N 8E; 6cmBS	147mm	112mm	61mm	Unprepared	Yes	5	No	
DlPb-2:7448	Fine Grained Quartzite	Ring 34d; Unit 2: 62N 34E; 19cmBS	130mm	92mm	31mm	Unprepared	No	1	No	
DlPb-2:7460	Coarse Grained Quartzite	Ring 34d; Unit 2: 95N 70E; 20cmBs	175mm	120mm	87mm	Unprepared	No	1	No	
DlPb-2:6557	Fine Grained Quartzite	Ring 34d; Unit 4: 85N 46E; 8cmBS	60mm	45mm	17mm	-	Yes	9+	No	
DlPb-2:5146	Quartz Crystal	Ring 34g; Unit 2: 39-47N 22-27E; 6cmBS	77mm	68mm	50mm	Unprepared	No	2	No	
DlPb-2:7221	Fine Grained Quartzite	Ring 33h; Unit 23: 30N 99E; 12cmBS	110mm	100mm	90mm	Unprepared	Yes	2	No	

Table 6 Basic Analytical Data, Cores (continued)

FLAKES

The category of flakes refers to any piece of lithic material detached intentionally or unintentionally in the course of flintknapping or tool use. The term 'flakes' covers primary and secondary decortication, waste (ie. block fracture and shatter), and secondary flakes, plus the rarer more specialized flake types (thinning, resharpening, retouch, edge preparation, core rejuvenation, and core preparation flakes).

Primary decortication flakes have the entire dorsal surface covered with cortex. Secondary decortication flakes have approximately one half of the dorsal surface covered with cortex. These flakes are frequently used as naturally backed knives.

Shatter and block fracture flakes are flakes of various sizes and shapes produced during core reduction. They lack definite shape, and occur as a result of core shattering, misdirected blows, overhangs on cores, or the use of poor quality material. The two are differentiated by shatters' lack of a prepared platform.

Secondary flakes is a relatively broad category comprised of those flakes removed during the course of tool production, but excluding the final stages of tool formation. This is roughly analogous to Magne's (1985) middle stage reduction.

The remaining flake types represent the final stages of tool manufacture plus maintenance (thinning flakes, retouch flakes, and resharpening flakes), as well as small flakes removed from cores (core rejuvenation and preparation flakes) not as an end in themselves, but to allow removal of additional secondary flakes.

HAMMERSTONES / ANVILS

Hammerstones generally consists of naturally rounded, usually unmodified, cobble sized rocks that are used as hand held hammers. They may be used in conjunction with flintknapping, or with other activities requiring a hammer, such as breaking bone in preparation for grease rendering. Anvils are cobble sized or larger rocks used as a base upon which to place the object being worked; they provide a solid platform for the splitting of raw material, such as pebble cherts, or for breaking bone for grease rendering. Hammerstones recovered from the Cranford Site are summarized in Table 7.

01

HAMMERSTONES

CATALOGUE NO.	MATERIAL TYPE	PROVENIENCE	DIMENSIONS MAX. LENGTH	MAX. WIDTH	MAX. THICKNESS	OUTLINE (SHAPE)	AMOUNT OF USE (pitting)	COMMENTS
DlPb-2:7685	Very Coarse Grained Quartzite	Ring 3d; Unit 1: 6N 50E; 9cmBs	90mm	79mm	18mm	Oval	Heavy	
DlPb-2:7711	Coarse Grained Quartzite	Ring 3d; Unit 2: 5N 69E; 5cmBS	93mm	36mm	25mm	Cylindrical	Light	
DlPb-2:7885	Coarse Grained Quartzite	Ring 33g; Unit 2: 85N 56E; 10cmBs	116mm	70mm	50mm	Oval	Heavy	
DlPb-2:7174	Coarse Grained Quartzite	Ring 33h; Unit 26: 50N 50E; 14cmBS	80mm	72mm	40mm	Triangular	Light	
DlPb-2:7049	Fine Grained Quartzite	Ring 33h; Unit 8: 80N 7E; 23cmBS	148mm	80mm	50mm	Cylindrical	Broken	
DlPb-2:6956	Fine Grained Quartzite	Ring 33h; Unit 6: 60N 40E; 13cmBS	99mm	81mm	53mm	Oval	Moderate	
DlPb-2:6568	Coarse Grained Quartzite	Ring 34d; Unit 2: 82N 19E; 19cmBS	88mm	65mm	45mm	Oval	Heavy	
			ANVILS					
DlPb-2:5119	Fine Grained Quartzite	Ring 34g; Unit 2: 68-81N 15-25E; 10cmBS	125mm	111mm	42mm	Oval	Broken	

Table 7 Basic Analytical Data, Hammerstones, Anvils

GRINDING STONE

One coarse grained quartzite grinding stone (DlPb-2:7589) was recovered from Ring 33c, Unit 1, Level 2:5-10cm BS. The object measures 152mm X 98mm X 65mm, is ovate in outline, and displays extensive use wear on one surface. The presence of a Pelican Lake point from this ring and level suggests the grinding stone is associated with the Pelican Lake phase.

POTTERY (Plate 15:8185)

One piece of pottery (DlPb-2:8185) was recovered from Ring 32l, Unit 18, Level 2 (5-10cm BS). Unfortunately, this sherd possesses no diagnostic attributes and cannot be categorized as to type. It measures 21mm X 15mm X 8mm.

GAMING PIECE (Plate 15:5200)

One possible gaming piece (DlPb-2:5200) was recovered from Ring 34g, Unit 6, Level 3 (10-15cm BS). The object, a well worn flat stone with an oval outline, measures 24mm X 20mm X 5mm.

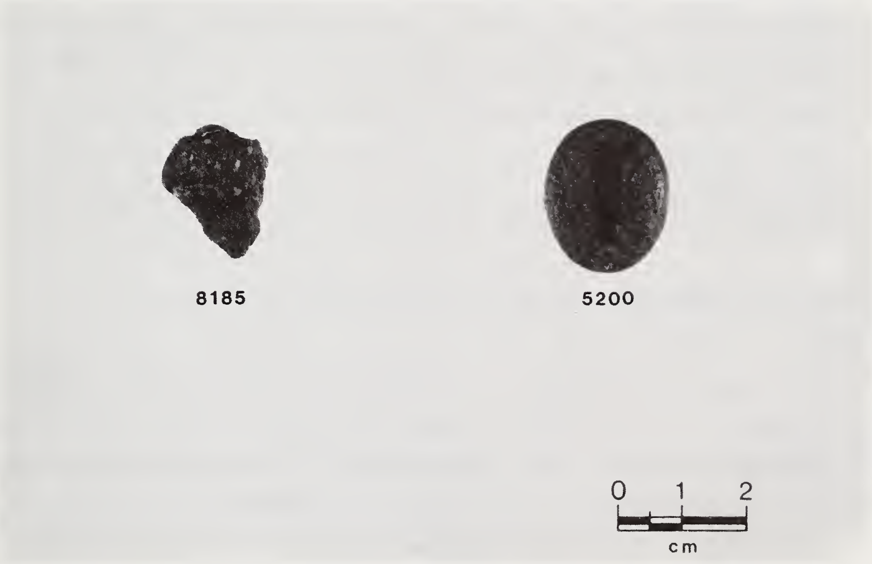

Plate 15 Potsherd and gaming piece recovered from DlPb-2.

GROUNDSTONE

One possible groundstone object (DlPb-2:7648) was recovered from Ring 33i, Unit 1:57N 86E, Level 5: 25cm BS. This object measures 75mm X 57mm X 20mm and is oval in outline. All the cortex, except for one rectangular area measuring 30mm X 13mm, has been worn off; no flake scars or use wear is present. If this object is of cultural origin, its use is unknown.

SPLIT PEBBLES / COBBLES and FLAKED COBBLES

The split pebbles / cobbles and flaked cobbles category is a small category consisting of those pieces of chert and quartzite raw material that were split or flaked and not subsequently worked nor utilized. It is assumed that after splitting or flaking the object, the flintknapper decided the material was not suitable and therefore discarded. A total of items fall into this category. As these objects display no evidence for any work other than the initial splitting, nor use, they will not be discussed further.

FIREBROKEN ROCK

A total of 1165 pieces of firebroken rock were recovered from excavations conducted during 1987. Firebroken rock is rock that has fractured as a result of rapid cooling following prolonged and/or repeated heating; a process germane to stone boiling or use in a sweat bath. Catlin (1973:154) describes stone boiling as employed by the Assiniboine:

> ... when they kill meat, a hole is dug in the ground about the size of a common pot, and a piece of raw hide of the animal, as taken from the back, is put over the hole, and then pressed down with the hands close around the sides and filled with water. The meat to be boiled is then put in this hole or pot of water; and in a fire, which is built near by, several large stones are heated to a red heat, which are successively dipped and held in the water until the meat is boiled ...

In addition to excavated pits, birch bark containers (Harper 1971:53) and buffalo skin basins (Wissler 1912:70), were also used.

As well as for cooking meat, stone boiling was used to render grease from bone. According to Leechman (in Spiess 1979:25), amongst the Vanta Kutchin,

> After the meat is cut off the bones, they are left for a day to dry. If left longer, the grease tastes "strong". A caribou skin is placed on the ground, and a large (anvil) stone is placed on it. The long bones are smashed against the stone with a [stone hammer] into pieces "as big as fingernails". (Presumably this process occurs after the marrow has been removed.) ... These small bone fragments are put in a pot over a fire, and the water temperature is kept just below the boiling point by adding snow or more water. The fat floats to the surface and is skimmed off. It is usually put in a cleaned caribou stomach where it will keep for several years if necessary. It is

> used in cooking and eating analogously to butter. [Parenthesis "()" in original.]

In addition to breaking as a result of heating followed by rapid cooling, rocks also fracture from heating alone. McParland (1977) suggests that rocks which fracture along bedding planes, or display cortical spalls, were likely heated only. Those rocks displaying more pervasive fractures, including disintegration into numerous very small fragments, are indicative of stone boiling (McParland 1977).

REFERENCES CITED

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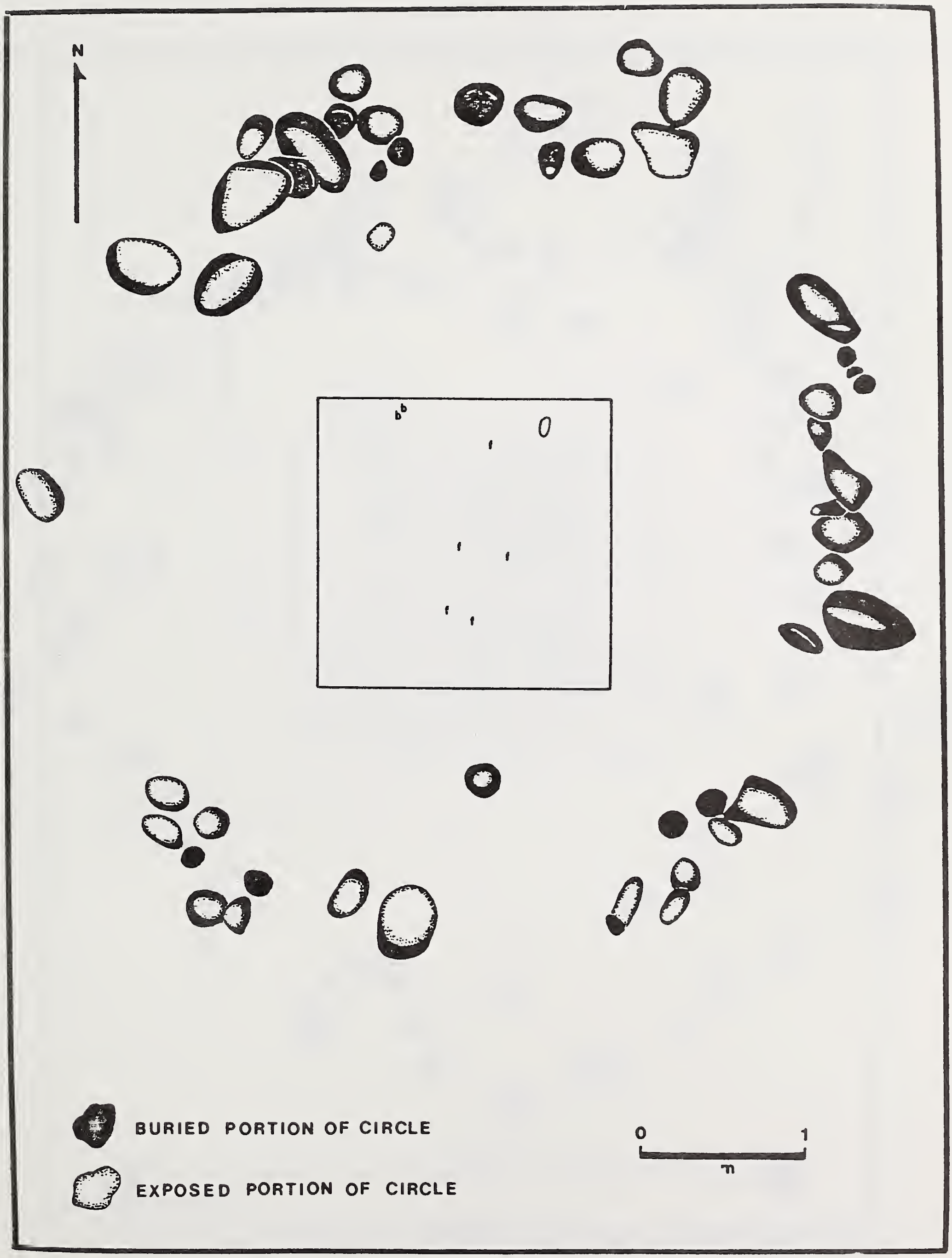
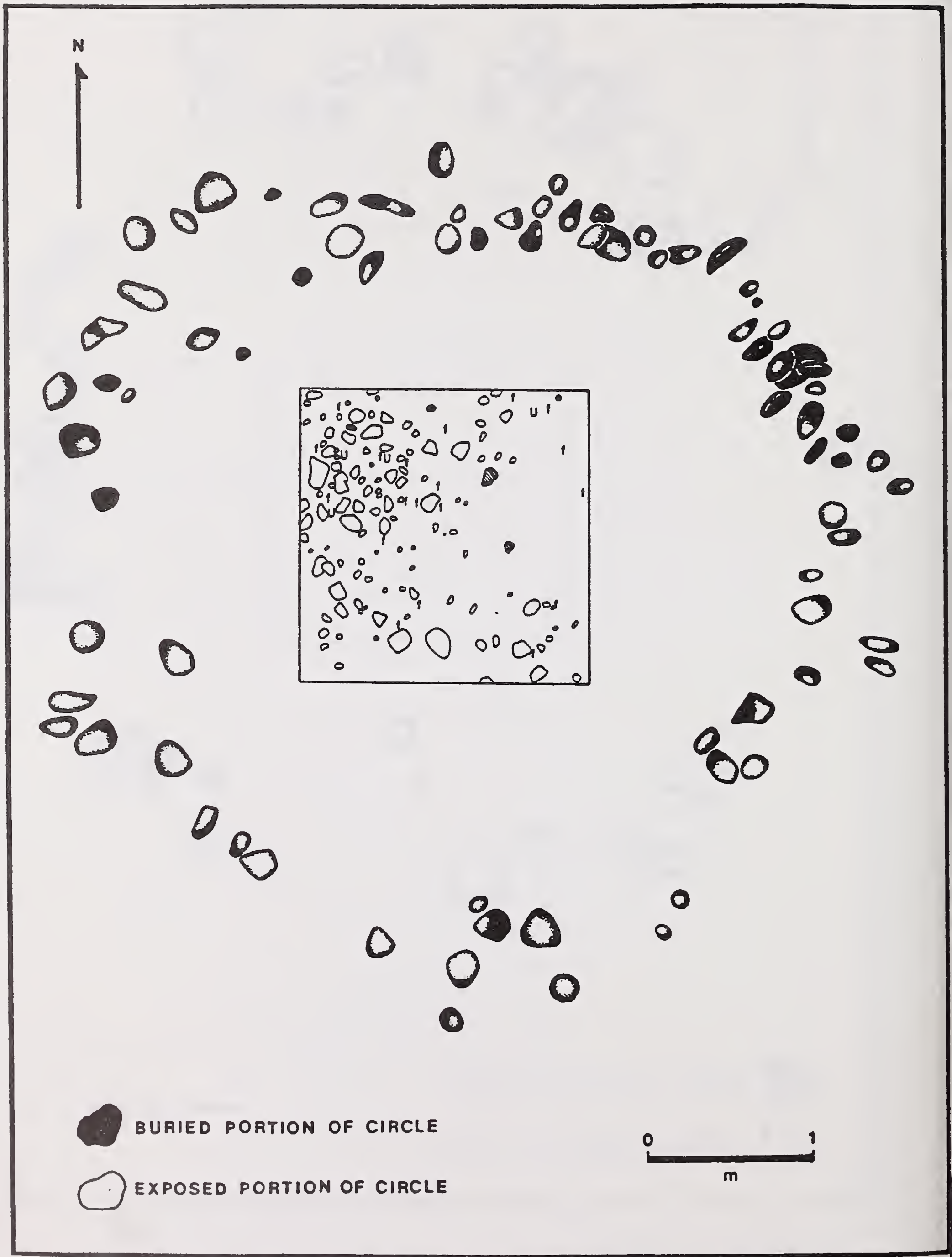
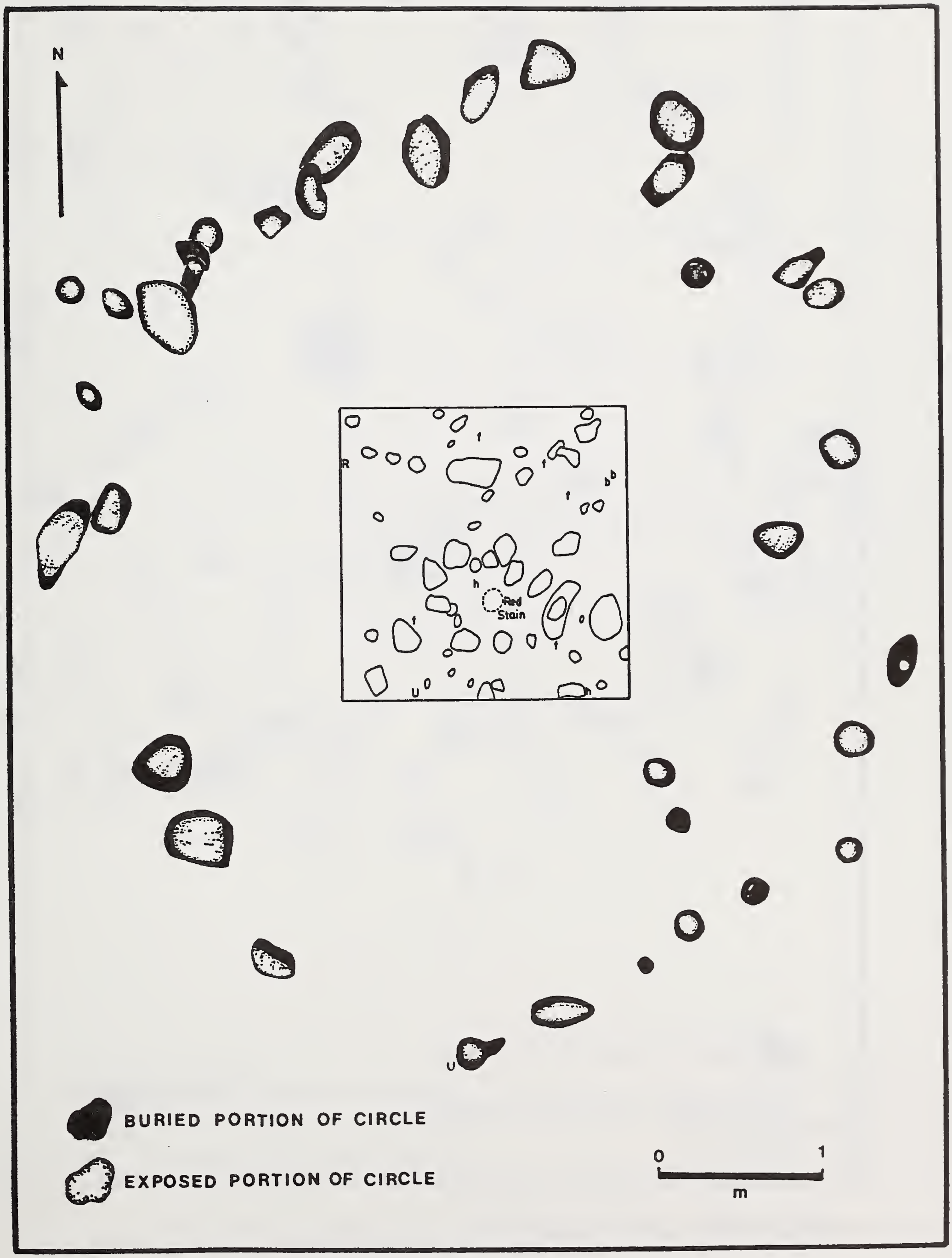


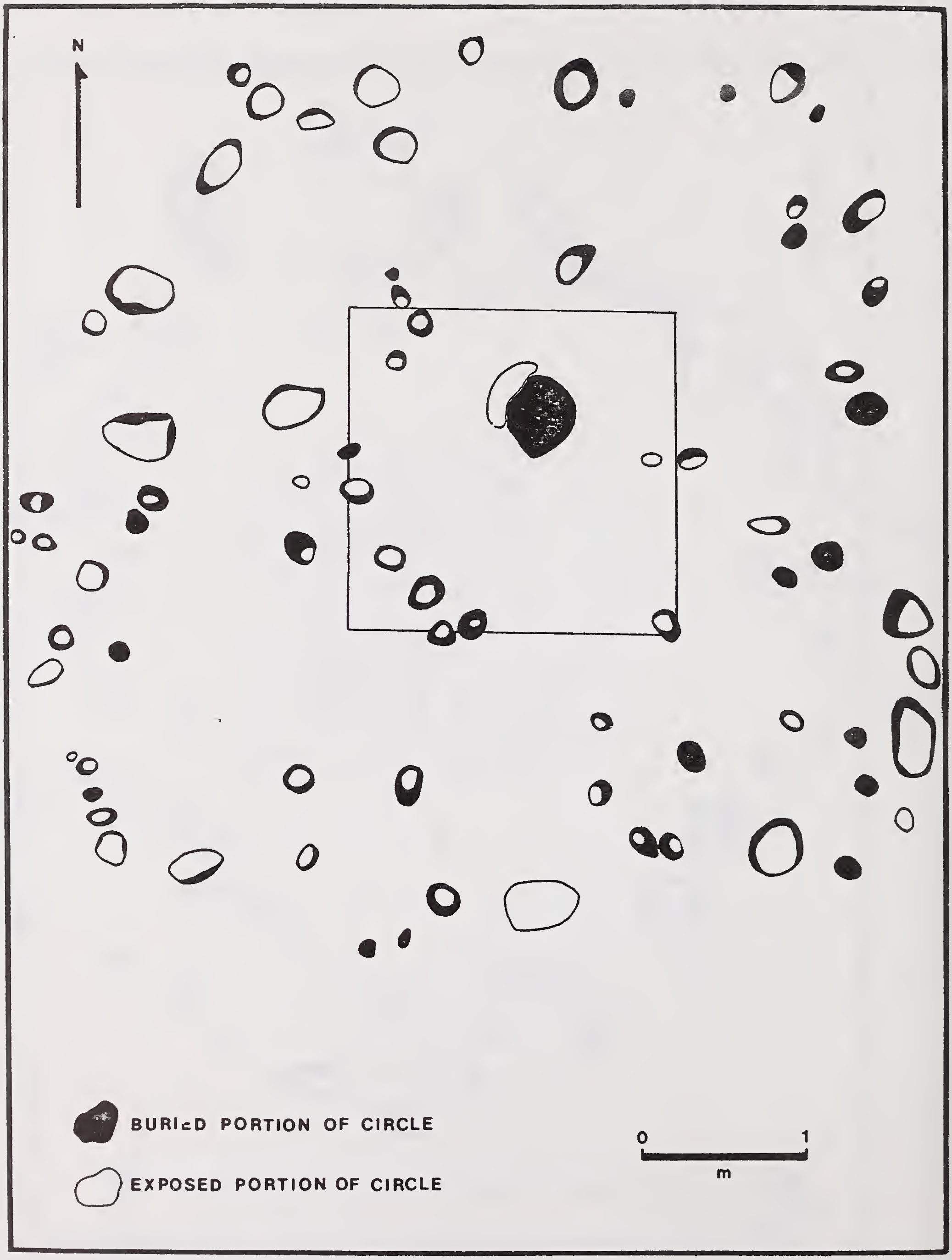
Feature Map: DlPb-2, Ring 3a



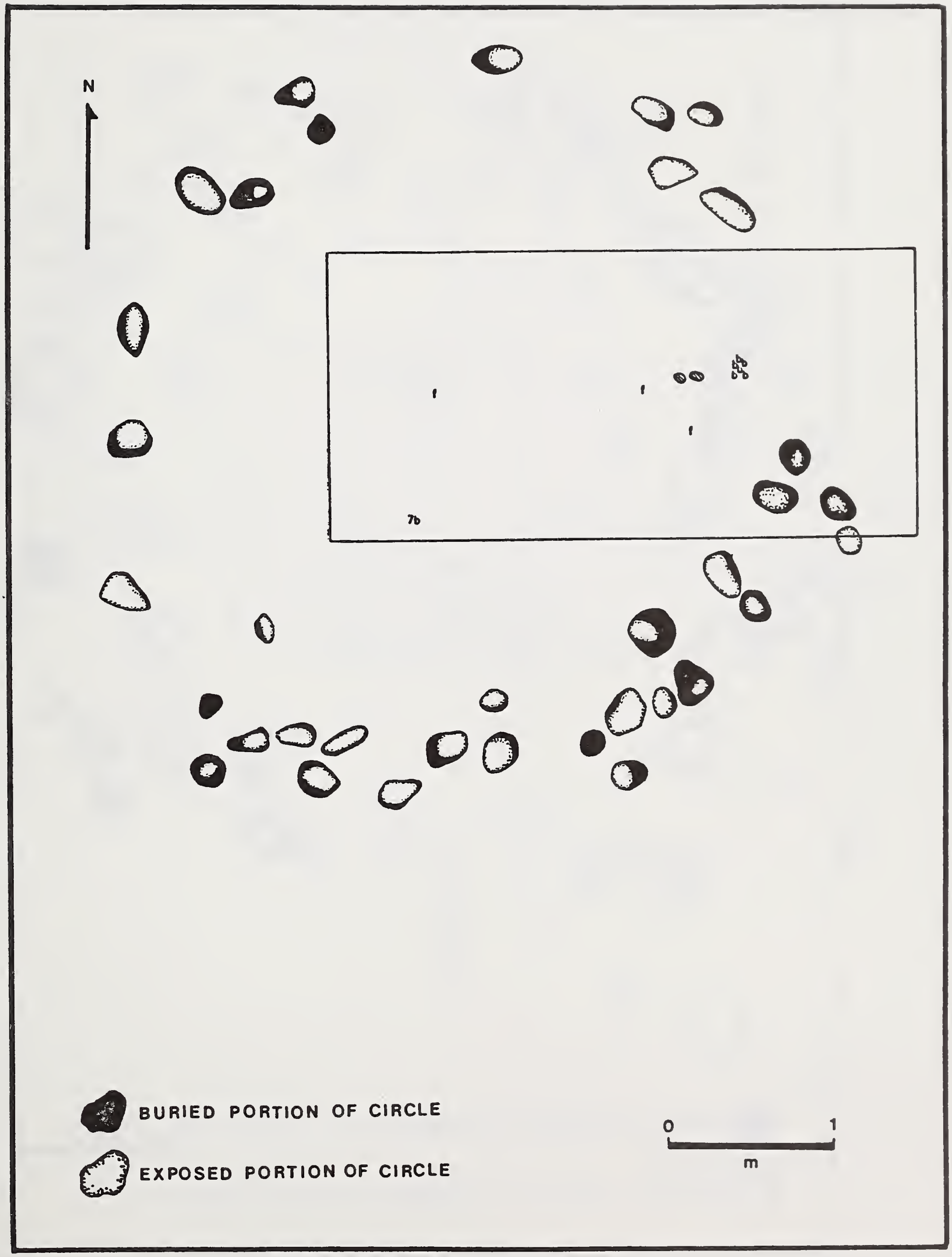
Feature Map: DlPb-2, Ring 3b



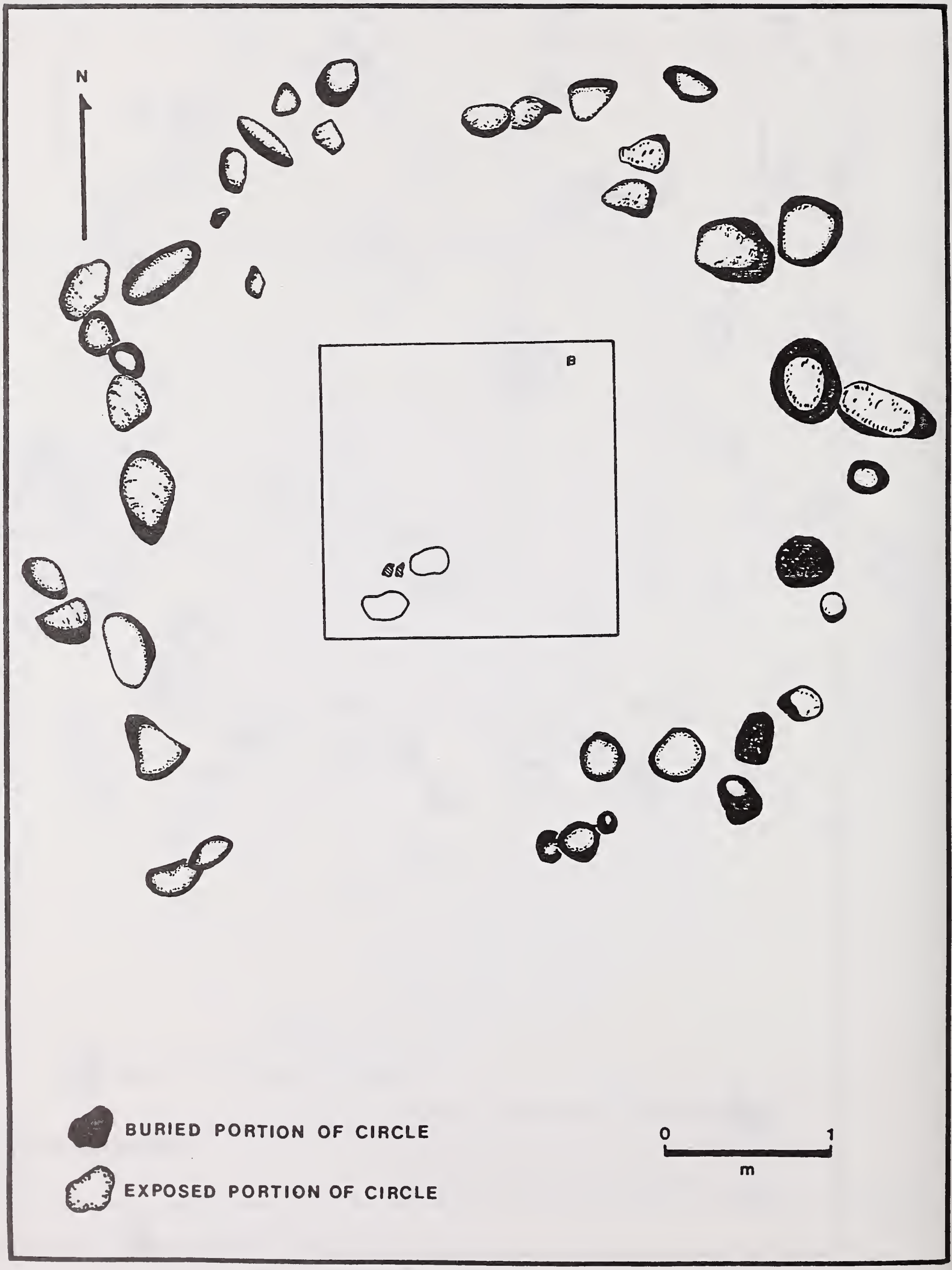
Feature Map: DlPb-2, Ring 3d



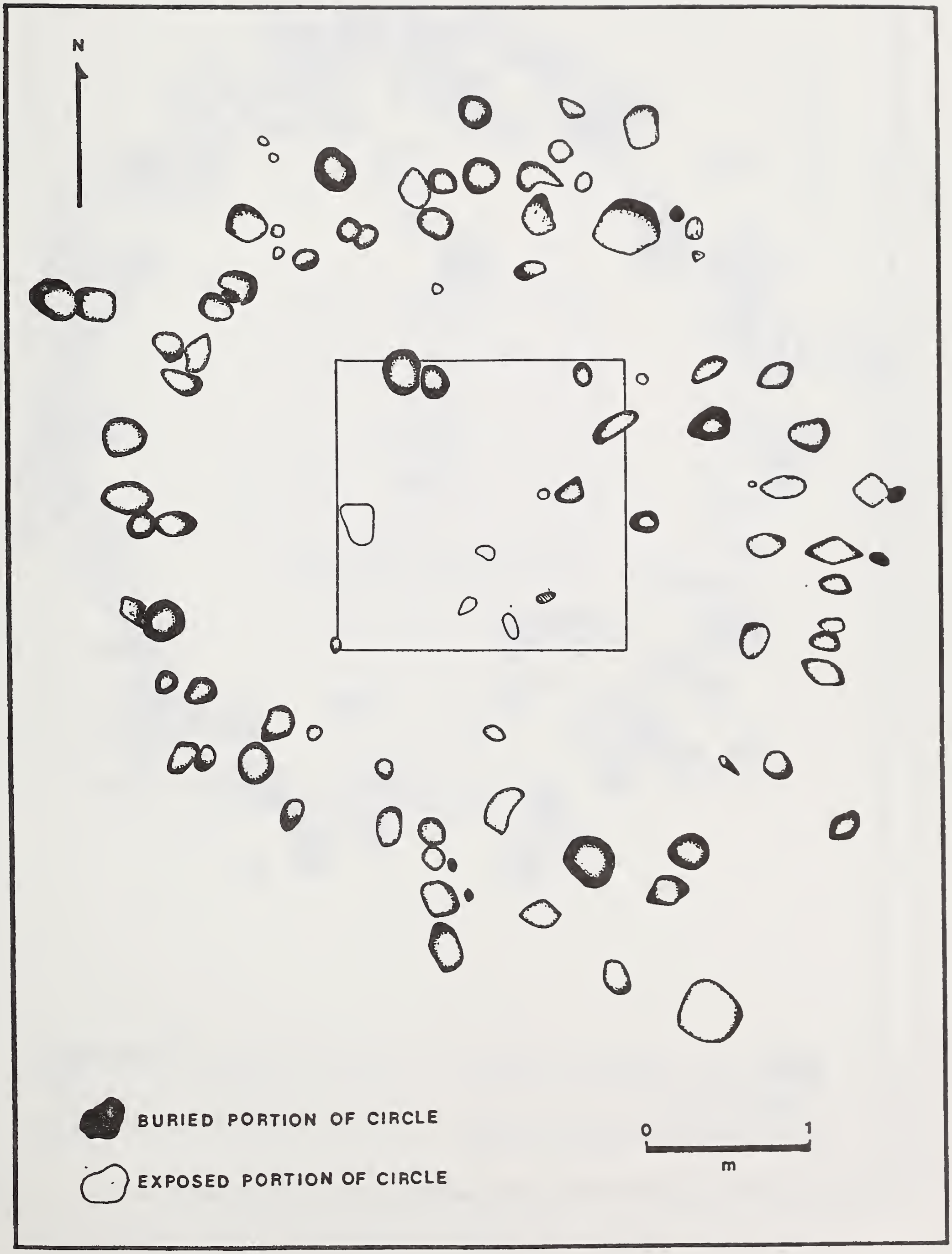
Feature Map: DlPb-2, Ring 4c



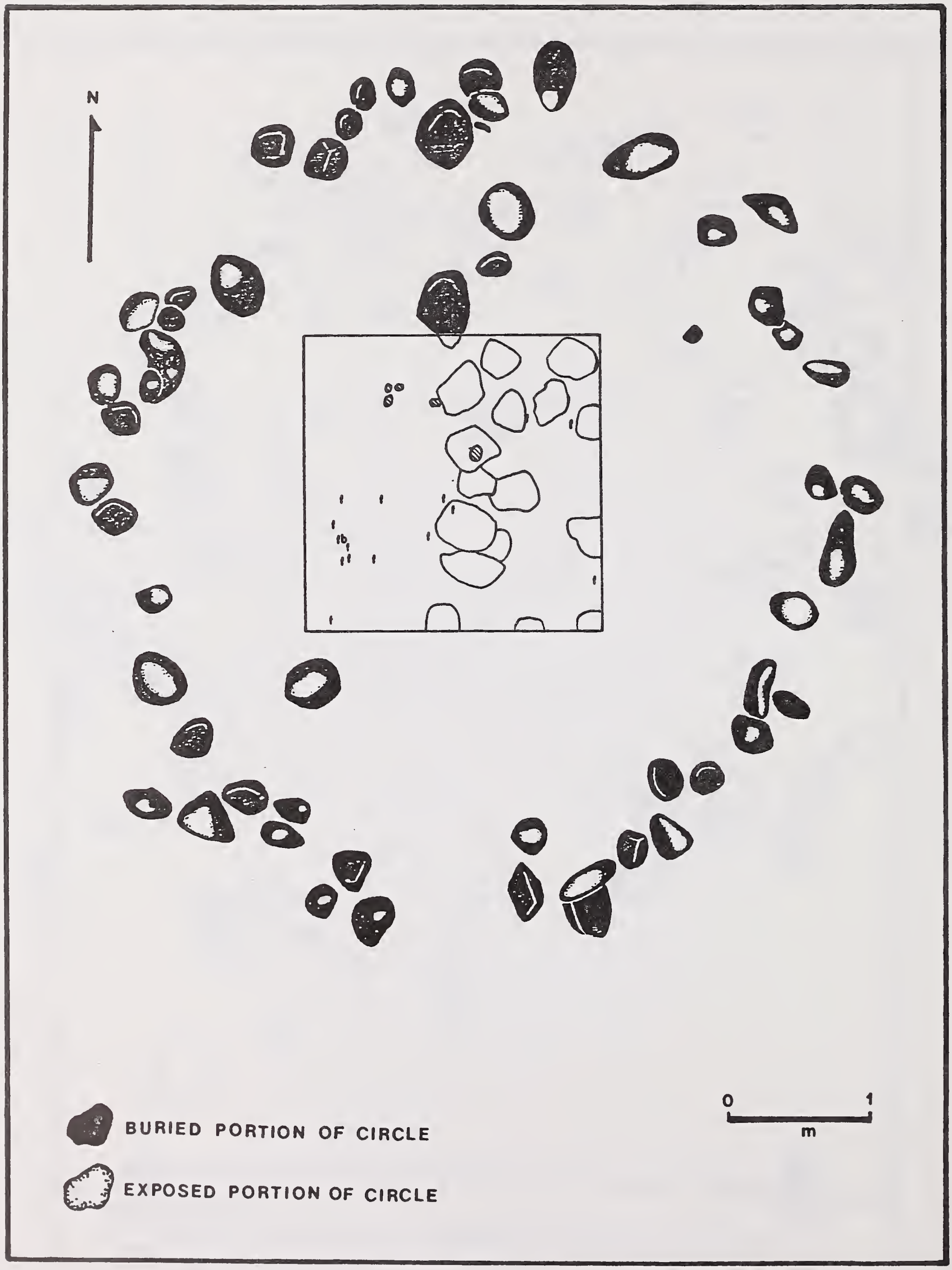
Feature Map: DlPb-2, Ring 4j



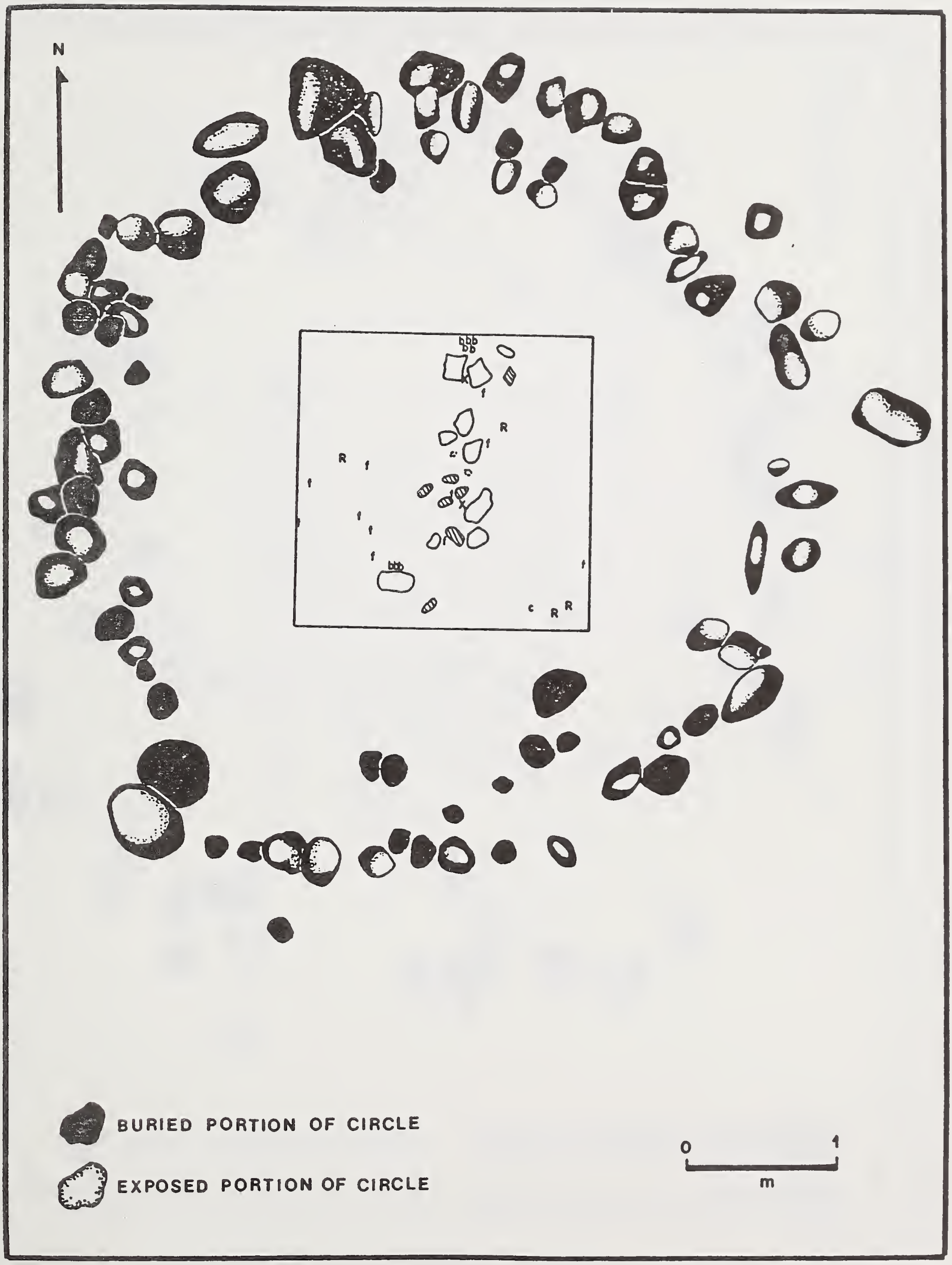
Feature Map: DlPb-2, Ring 4k



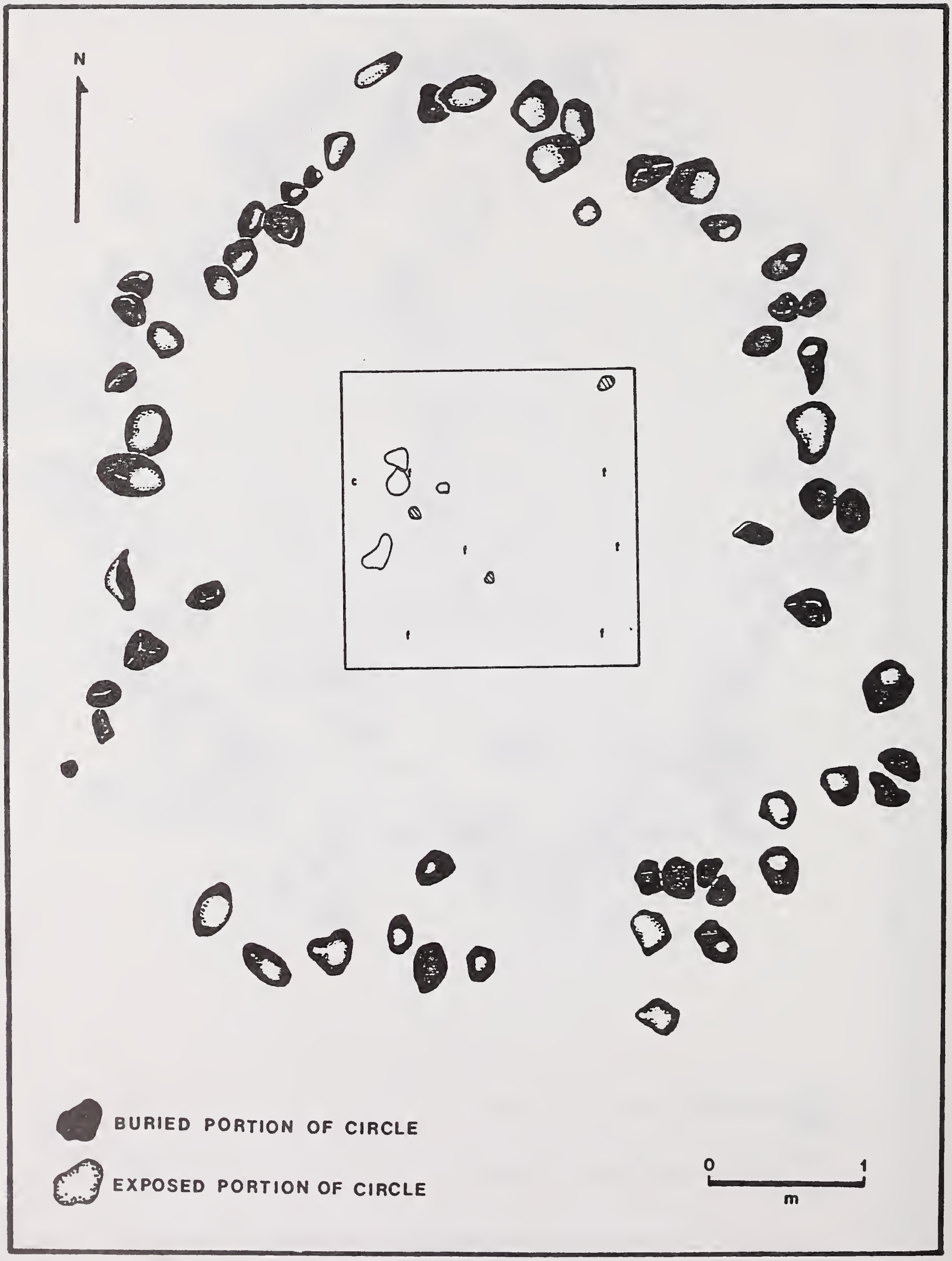
Feature Map: DlPb-2, Ring 33a



Feature Map: DlPb-2, Ring 33f



Feature Map: DlPb-2, Ring 33i



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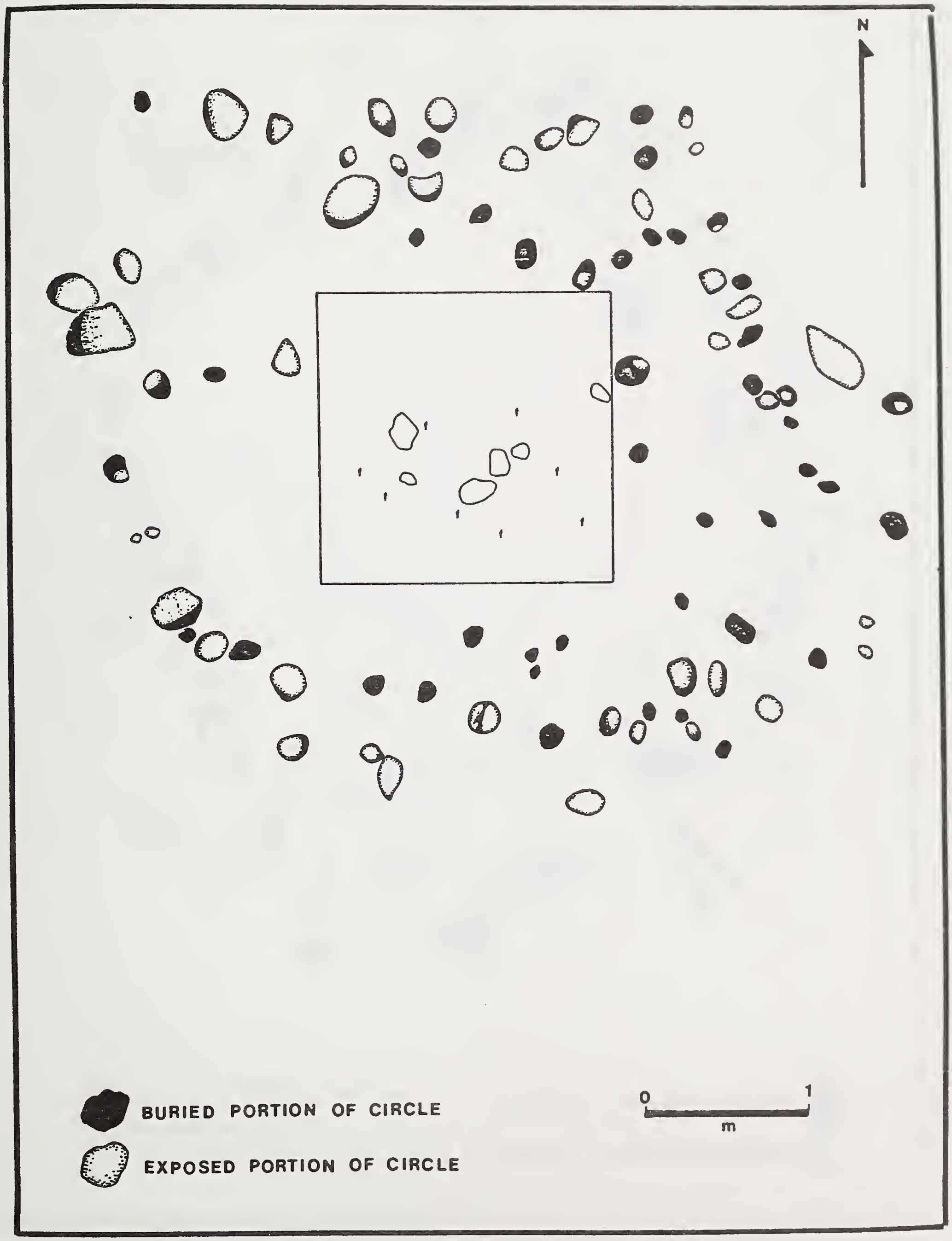

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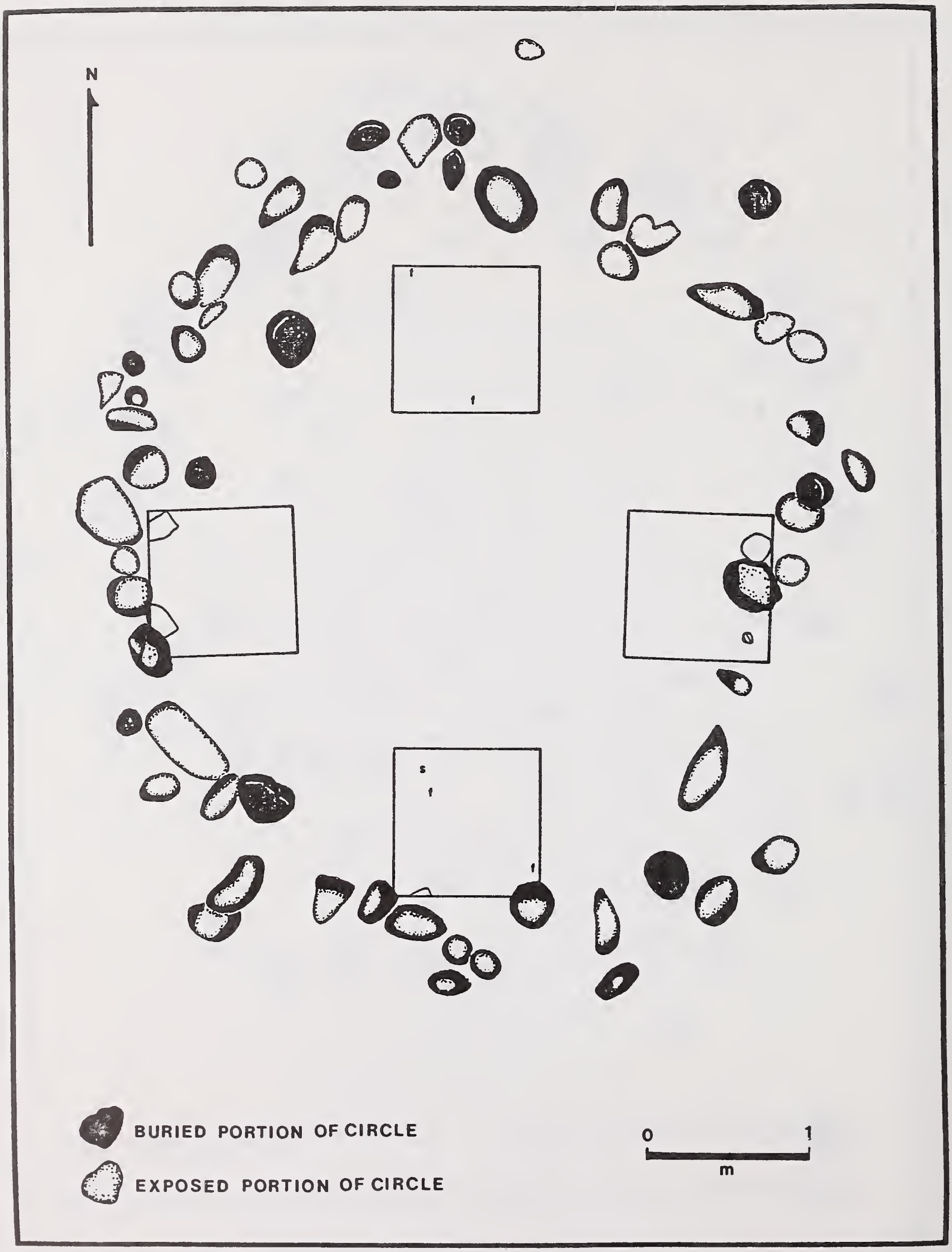

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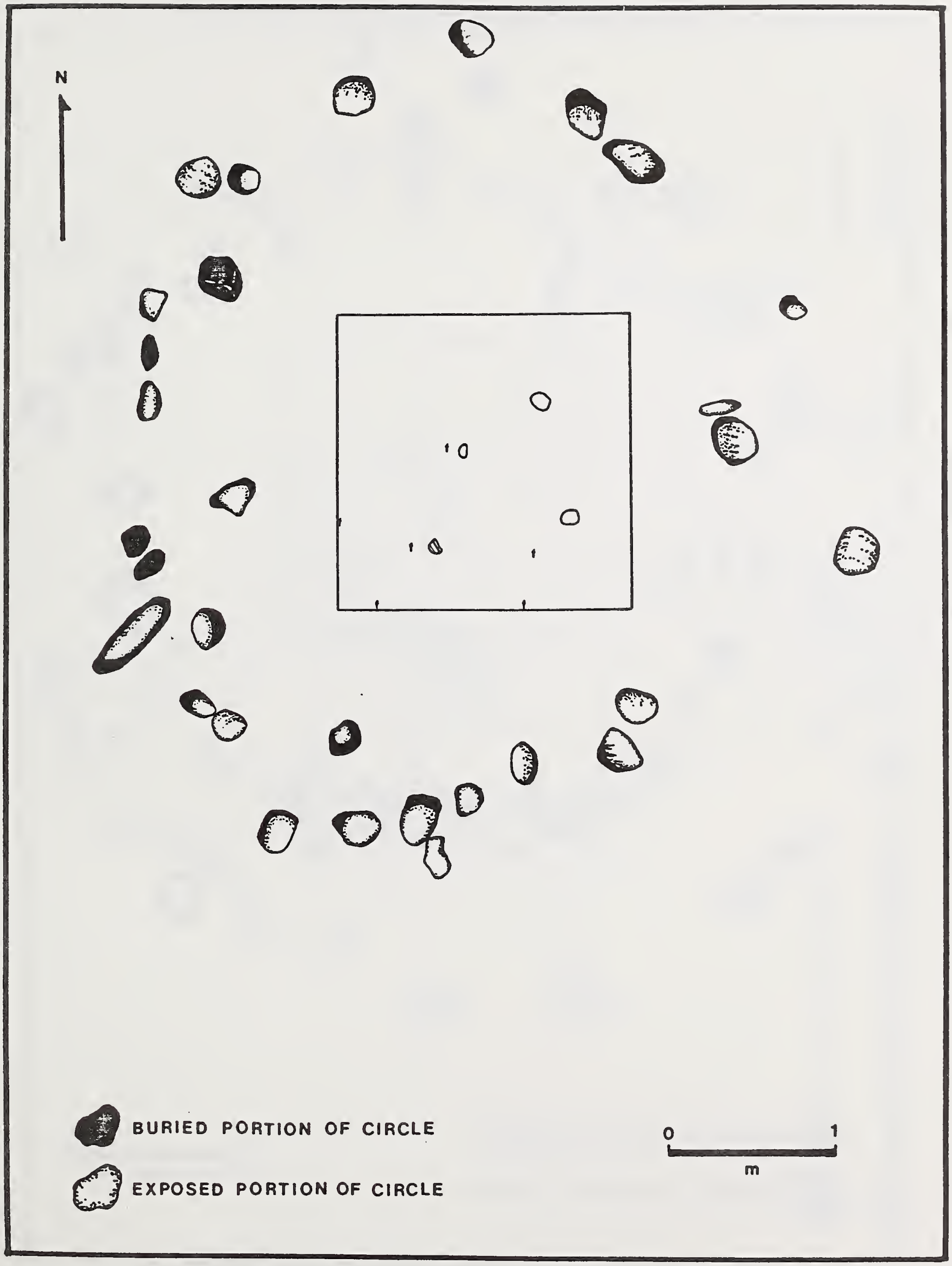
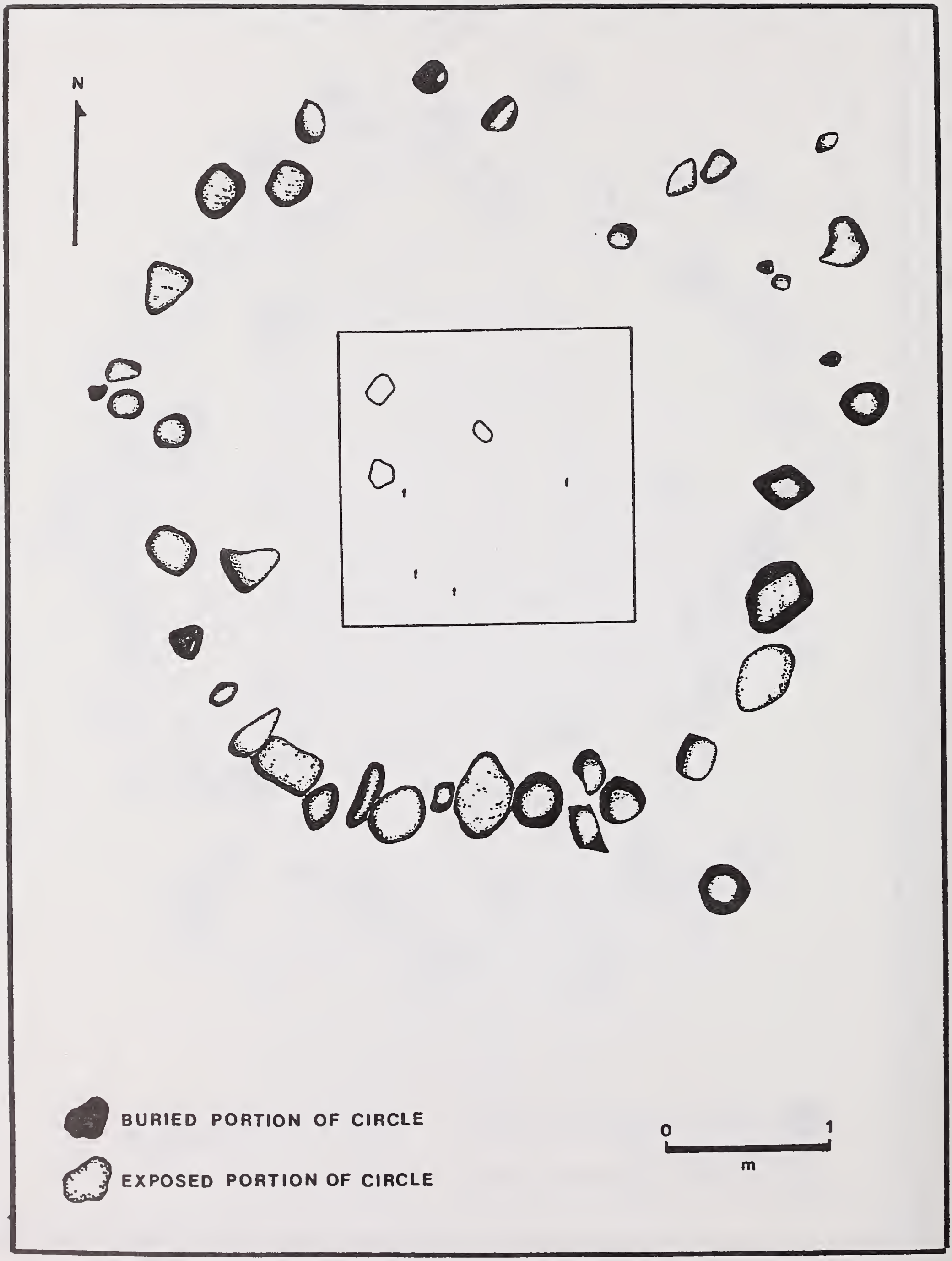
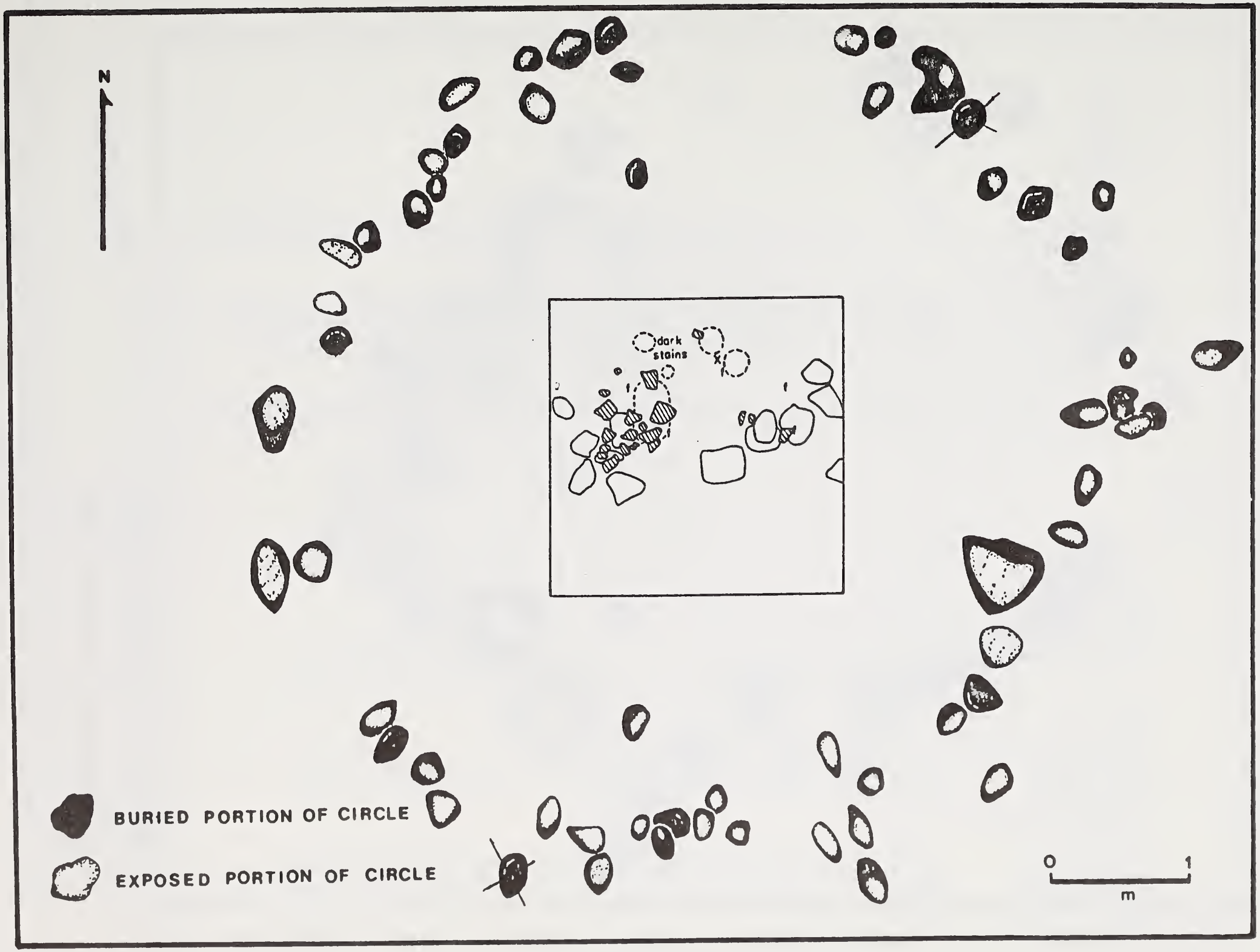


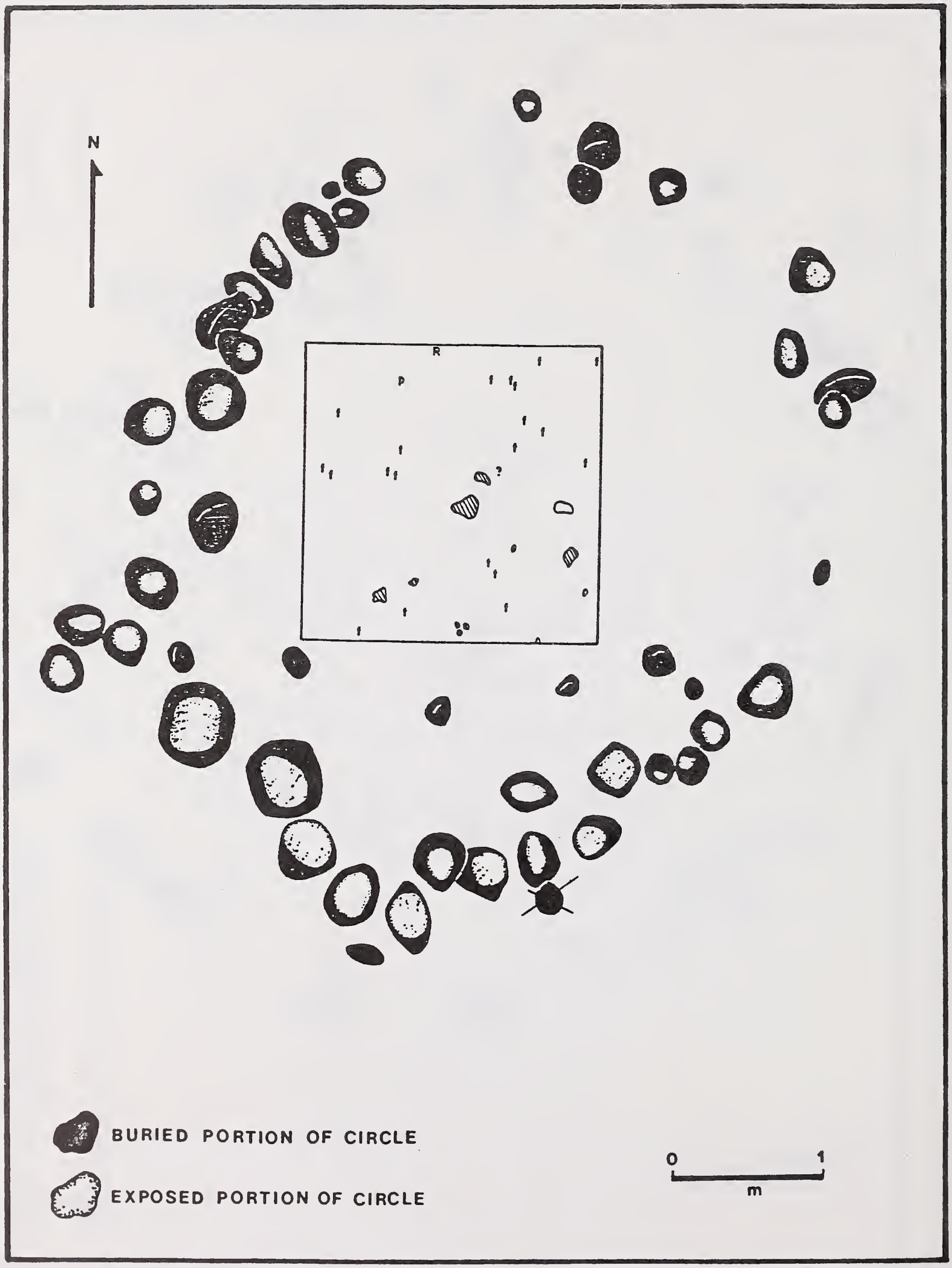
Feature Map: DlPb-2, Ring 34e



Feature Map: DlPb-2, Ring 34f



Feature Map: DlPb-2, Ring 34h



Feature Map: DlPb-2, Ring 34i

RING 3a

Diametres:		Inside	Outside	Average
	North South	4.30m	5.30m	4.80m
	Northeast - Southwest	4.65m	5.60m	5.12m
	East-West	4.55m	5.15m	4.85m
	Southeast-Northwest	4.50m	5.55m	5.02m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	29.5	16	SE	27	20	15
	2	5	13		28	2	11
	3	4	12		29	7.5	13
	4	11.5	13		30	4	11
	5	15.5	19		31	4.5	13
	6	8.5	13		32	7	13
	7	6	10		33	13.5	16
	8	5.5	12	S	34	4	14
	9	14	16		35	23	19
	10	6.5	17		36	18	19.5
	11	23	16	SW	37	3.5	16
	12	17	17		38	10	14
NE	13	25	22		39	15	16
	14	28.5	19		40	4	15
	15	14.5	17		41	3.5	18
	16	12.5	14		42	9	18
	17	6	16		43	6.5	14
E	18	6	14	W	44	19.5	17
	19	10.5	15	NW	45	24.5	20
	20	10	15		46	22	17
	21	17	19		47	42	23
	22	8.5	14		48	10.5	15
	23	16.5	18		49	6	13
	24	8.5	14				
	25	16	16				
	26	3	10				

RING 3b

		Inside	Outside	Average
Diametres:	North South	4.65m	5.65m	5.15m
	Northeast - Southwest	5.90m	4.70m	5.30m
	East-West	6.00m	4.80m	5.40m
	Southeast-Northwest	6.00m	5.10m	5.65m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	10	14	E	42	5	9.5
	2	15.5	15		43	4	10.5
	3	7	11	SE	44	11	12
	4	12	12		45	8	13
	5	6.75	10		46	5	11
	6	4	10.5		47	7	13
	7	8	10		48	1	8
	8	3	10		49	2	9
	9	10	14	S	50	11	13
	10	5	10		51	13	11
	11	6	12		52	9	12
	12	1	6		53	6	10
	13	4	13		54	11	15
NE	14	8	14		55	5	9
	15	6	13		56	10	12
	16	5	12	SW	57	18	10
	17	4	9.5		58	5	11
	18	6	10		59	8	13
	19	6	11		60	20	15
	20	9	16		61	19	13
	21	6	12		62	7.5	13
	22	2	10		63	7	12
	23	4	11		64	14	15
	24	8	12	W	65	18	15
	25	12	14		66	4	16
	26	11	14		67	6	9
	27	9	12		68	17.5	13
	28	14	16	NW	69	6	14
	29	8	13		70	3.5	15
	30	9	14		71	11	14
	31	5	12		72	1	11
	32	6	14		73	5.5	10
	33	5	13		74	11.5	14
	34	6	14		75	9	13
	35	8	13		76	6.5	13
E	36	5	14		77	13.5	15
	37	13	15		78	4	15
	38	5	12		79	1.5	8
	39	6	14				
	40	15	15				
	41	5	12				

RING 3d

		Inside	Outside	Average
Diametres:	North South	5.40m	6.18m	5.80m
	Northeast - Southwest	4.75m	5.40m	5.08m
	East-West	4.37m	5.15m	4.76m
	Southeast-Northwest	4.88m	5.55m	5.22m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	13	12	NW	27	5	12
	2	17	10		28	30	14.5
	3	17	14		29	5	11.5
	4	17	12		30	5	10
NE	5	11	12		31	8	12
	6	13	10.5		32	5	11.5
	7	3	13.5		33	5	11
	8	7	11		34	6	11.5
	9	7	11				
E	10	22	17				
	11	10	15.5				
	12	4	8.5				
SE	13	6	9.5				
	14	3	11.5				
	15	4	11				
	16	4	9				
	17	3	11				
	18	5	10				
	19	2	9				
S	20	10	10				
	21	7	12				
SW	22	5	11				
	23	11	9.5				
	24	11	10				
W	25	20	12				
	26	12	10.5				

RING 4j

		Inside	Outside	Average
Diametres:	North South	4.00m	4.68m	4.34m
	Northeast - Southwest	3.96m	4.30m	4.16m
	East-West	3.90m	4.64m	4.27m
	Southeast-Northwest	4.40m	3.65m	4.02m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	7	12	W	30	11	13
NE	2	5	14		31	6	10
	3	4.5	13	NW	32	9	11
	4	8	14		33	6.5	12
	5	10	15		34	8	14
E	6	3	9		35	8	10
	7	5	10				
	8	6	9				
	9	4	8				
SE	10	7.5	11				
	11	6	10				
	12	14	14				
	13	12	13				
	14	4.5	10				
	15	7	9				
S	16	6.5	10				
	17	8	11				
	18	5	9				
	19	4	8				
	20	7	10				
	21	6	11				
SW	22	8	9				
	23	7	8				
	24	7	9				
	25	5.5	10				
	26	10	12				
	27	2	8				
	28	3	6				
	29	10.5	12				

RING 4k

		Inside	Outside	Average
Diametres:	North South	4.41m	4.95m	4.68m
	Northeast - Southwest	4.25m	5.00m	4.62m
	East-West	4.10m	5.00m	4.55m
	Southeast-Northwest	4.25m	5.00m	4.62m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)
N	1	10.5	11
	2	11	16
	3	8	12
	4	7.5	14
	5	10.5	14
NE	6	7	11
	7	12.5	17
	8	15	12
	9	27	19
	10	17.5	19
E	11	17	18
	12	36	20
	13	4.5	12
	14	10.5	13
	15	7.5	14
SE	16	15.5	16
	17	14.5	18
	18	18	22
	19	19	18
	20	10.5	21
S	21	9.5	18
	22	10	15
	23	11.5	15
SW	24	6	15
	25	10	14
	26	20	15
W	27	19	16
	28	17.5	17
	29	15	19
	30	21	20
	31	13.5	17
	32	5	14
W	33	10.5	15
NW	34	18.5	19
	35	19	15
	36	1.5	7
	37	5	15
	38	16	15
	39	23	19
	40	9	14

RING 321

		Inside	Outside	Average
Diametres:	North South	4.90m	6.10m	5.50m
	Northeast - Southwest	5.30m	6.20m	5.75m
	East-West	4.80m	5.50m	5.15m
	Southeast-Northwest	4.8m	5.6m	5.20m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)
N	1	2	6
	2	14	11
	3	5	9
	4	5	9
	5	8	15
	6	16.5	10
	7	2	10
NE	8	20	17
	9	15	11
	10	22	14
	11	20	15
	12	24	16
E	13	26	18
SE	14	7	10
	15	5	10
	16	9	12
S	17	45	16
	18	30	16
	19	20	14
	20	50	16
	21	32	15
	22	30	15
	23	5	10
	24	7	11
	25	8	10
	26	2	8
	27	5	17
	28	9	16
SW	29	4	11
	30	8	10
	31	25	14
	32	31	16
	33	39	15
	34	15	13
	35	22	14
SW	36	12	18
	37	11	17
	38	9	17
	39	5	11
	40	9.5	18
	41	4.5	10
	42	4	9
	43	8	14
	44	25	13
	45	28	14
W	46	25	14
	47	27	14
	48	30	12
NW	49	22	12
	50	20	11
	51	13	10
	52	29	15
	53	12	10

RING 33a

		Inside	Outside	Average
Diametres:	North South	3.70m	4.70m	4.20m
	Northeast - Southwest	3.90m	5.10m	4.50m
	East-West	3.90m	5.40m	4.65m
	Southeast-Northwest	4.50m	5.80m	5.15m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	5	10	S	47	3.5	7
	2	4	10		48	8	11
	3	4	9		49	30	23
	4	4.5	12		50	10.5	10
	5	5	10		51	2	7
	6	9	12		52	9.5	13
	7	19	22		53	22	18
	8	4	10		54	4.5	12
	9	7	11		55	1.5	14
	10	6	13		56	6	13
	11	11	13		57	4.5	13
	12	3.5	9		58	6	9
	13	1.5	7		59	2	8
	14	3.5	10	SW	60	5	10
NE	15	16.5	13		61	10	12
	16	2	6		62	1	3
	17	11	8		63	21	20
	18	2	7		64	6	12
	19	2	9		65	7	13
	20	2	5		66	7.5	13
	21	6	11		67	1	6
	22	5	12		68	3.5	10
	23	7	9	W	69	6.5	12
E	24	1	4		70	6	11
	25	4	10		71	14	19
	26	3.5	10		72	6	9
	27	18	14		73	11	11
	28	10	13		74	8	14
	29	1	3	NW	75	4	8
	30	7	9		76	5.5	13
	31	7	10		77	5.5	11
	32	9	12		78	12	13
	33	12.5	15		79	25	18
	34	9.5	11		80	10	11
	35	8	12		81	5.5	11
	36	7	9		82	3.5	13
	37	5	10		83	13.5	14
	38	8	13		84	6	13
SE	39	9	12		85	4	10
	40	10.5	13		86	5	12
	41	6	9		87	9.5	11
	42	8.5	14		88	3.5	13
	43	6	13		89	5	15
	44	7	14		90	6	13
	45	5.5	13		91	4.5	13
	46	20	17		92	5	11

RING 33f

Diametres:		Inside	Outside	Average
	North-South	4.70m	5.38m	5.04m
	Northeast - Southwest	4.30m	5.00m	4.65m
	East-West	4.34m	5.21m	4.78m
	Southeast-Northwest	4.25m	5.24m	4.74m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	12.5	16	S	31	5	13
	2	4.5	18		32	10	12
	3	4.5	14		33	5	9
	4	10	16		34	5	13
	5	7.5	13		35	9.5	16
	6	1	5		36	13	15
	7	8	14		37	8	16
	8	8	12		38	2.5	11
	9	8	14	SW	39	7.5	15
	10	4	15		40	6	14
	11	14	16		41	2	10
	12	17	19		42	12.5	14
NE	13	9.5	15		43	11	16
	14	9.5	9		44	5.5	12
	15	6	10		45	3	10
	16	1	5		46	13	18
	17	9	14	W	47	7.5	16
	18	5	12		48	6	14
E	19	9	15		49	14.5	14
	20	14.5	13		50	5.5	13
	21	5	13		51	8.5	15
	22	12	17		52	0.5	3
	23	5.5	14	NW	53	11	14
SE	24	10	14		54	2	3
	25	7.5	14		55	11	19
	26	4.5	10		56	15	15
	27	7	12		57	11	17
	28	6.5	13		58	16	18
	29	6.5	13				
	30	5.5	10				

RING 33i

		Inside	Outside	Average
Diametres:	North-South	4.30m	5.40m	4.85m
	Northeast - Southwest	4.20m	5.35m	4.78m
	East-West	4.26m	5.22m	4.74m
	Southeast-Northwest	4.72m	5.77m	5.24m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	21.5	16	S	43	10	18
	2	18	20		44	6	14
	3	11	14		45	5.5	17
	4	5	15		46	9.5	13
	5	40	19		47	9	19
	6	8	15		48	12.5	21
	7	10	14		49	5	18
	8	7.5	10		50	6	19
	9	30	22		51	19	20
	10	7	11		52	13	14
	11	7.5	11		53	16	16
	12	6	9	SW	54	4	14
	13	8	11		55	4	14
	14	6	11		56	23.5	17
	15	7	11		57	13	15
NE	16	7	10		58	6	13
	17	7	12		59	4.5	14
	18	10	13		60	8.5	14
	19	10	11		61	4	16
	20	9.5	12		62	10	18
	21	13	13	W	63	21	22
	22	10.5	11		64	19	16
	23	16.5	13		65	11	16
	24	13.5	14		66	3.5	11
E	25	16.5	15		67	10	15
	26	23	18		68	7.5	16
	27	6	12		69	5	15
	28	9	13		70	5.5	16
	29	10	12		71	12	16
	30	5.5	12		72	6	17
SE	31	7.5	15	NW	73	2.5	16
	32	9	15		74	1	10
	33	15	13		75	1.5	14
	34	5	14		76	5.5	14
	35	8	15		77	4.5	11
	36	4	12		78	5.5	14
	37	9.5	15		79	6	13
	38	3	13		80	5	11
	39	10	14		81	15	18
S	40	5	13		82	17	12
	41	3	14		83	15	13
	42	10	14				

RING 33j

Diametres:		Inside	Outside	Average
	North-South	5.21m	5.91m	5.56m
	Northeast - Southwest	5.07m	5.72m	5.40m
	East-West	4.30m	5.02m	4.66m
	Southeast-Northwest	4.82m	5.53m	5.18m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	8	16	S	31	11.5	19
	2	9	16		32	8	15
	3	15.5	16		33	7	13
	4	11	13		34	5.5	12
	5	14	13		35	7	12
	6	11.5	12		36	5	12
	7	5	10		37	6	13
	8	6	12	SW	38	6	11
NE	9	7	14		39	8	13
	10	5.5	10		40	10	14
	11	5.5	9		41	1	10
	12	4.5	9		42	4	11
	13	3.5	11	W	43	1.5	11
	14	3	11		44	8	16
	15	10	12		45	6	13
E	16	29.5	17		46	22	14
	17	9	16		47	19	16
	18	6	16		48	22	19
	19	7	17		49	6.5	13
	20	9.5	12	NW	50	8	15
SE	21	6	12		51	6	9
	22	3	15		52	4	13
	23	4	15		53	7	13
	24	7	11		54	8	14
	25	12.5	18		55	10	15
	26	7	13		56	7	17
	27	5.5	12		57	6	15
	28	4.5	12		58	4	12
	29	17	18		59	6	13
	30	7.5	17				

RING 34b

		Inside	Outside	Average
Diametres:	North-South	3.36m	3.95m	3.66m
	Northeast - Southwest	4.47m	5.04m	4.76m
	East-West	4.10m	4.90m	4.50m
	Southeast-Northwest	3.50m	4.04m	3.77m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	3.5	14	SW	36	5	9
	2	9.5	15		37	10.5	15
	3	5	14		38	12	16
	4	5	9		39	21.5	15
	5	6	11	W	40	1	5
	6	3.5	12		41	0.5	3
	7	3	9		42	4.5	9
	8	5.5	9		43	4	12
NE	9	1.5	7		44	39	22
	10	2.5	8		45	13	13
	11	3	7	NW	46	7	9
	12	3	9		47	11.5	15
	13	2.5	8		48	1.5	3
	14	2.5	11		49	6.5	12
	15	3	7		50	14	9
	16	3.5	11				
	17	4	12				
E	18	28	12				
	19	3	8				
	20	2.5	7				
	21	2.5	6				
	22	4.5	9				
SE	23	1	10				
	24	2	7				
	25	2	8				
	26	2	7				
	27	3	9				
	28	3	9				
	29	3	11				
	30	1.5	6				
S	31	9	14				
	32	5	12				
	33	3	11				
	34	5	9				
	35	3	9				

RING 34c

Diametres:		Inside	Outside	Average
	North-South	4.20m	4.92m	4.56m
	Northeast - Southwest	4.07m	4.86m	4.46m
	East-West	3.68m	4.60m	4.14m
	Southeast-Northwest	3.90m	4.53m	8.43m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	6	12	W	35	3	12
	2	21	18		36	2	9
	3	4.5	10		37	10	11
	4	8.5	11		38	3.5	8
	5	8	12		39	4	12
NE	6	12	14		40	21	15
	7	6.5	10		41	6.5	12
	8	9.5	10	NW	42	6.5	11
	9	8	16		43	2	10
	10	11	16		44	2.5	8
	11	4	11		45	4	12
E	12	5	10		46	2.5	11
	13	4.5	12		47	3.5	11
	14	10	15		48	10	11
	15	8	13		49	12	11
	16	14	9		50	43	28
	17	5	9		51	2	13
SE	18	8.5	10				
	19	5	10				
	20	9	11				
S	21	7.5	10				
	22	7	6				
	23	8	9				
	24	5.5	12				
	25	3.5	12				
	26	3	13				
	27	7	10				
	28	8.5	9				
SW	29	6	12				
	30	7.5	13				
	31	8	12				
	32	7	13				
	33	7.5	13				
	34	24.5	11				

RING 34e

		Inside	Outside	Average
Diametres:	North-South	4.07m	4.65m	4.36m
	Northeast - Southwest	3.73m	4.30m	4.02m
	East-West	3.26m	4.00m	3.63m
	Southeast-Northwest	4.43m	3.85m	4.14m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	19	18	NW	27	5.5	14
	2	16	16		28	14	16
	3	23	15		29	33	17
NE	4	32.5	16		30	7	12
	5	4	10				
E	6	6	11				
	7	10	14				
	8	35.5	18				
SE	9	22	16				
	10	14	16				
S	11	9.5	10				
	12	9	12				
	13	8	11				
	14	6.5	11				
	15	15	13				
SW	16	14	14				
	17	23	26				
	18	6	6				
	19	6	14				
	20	9	12				
	21	22.5	14				
W	22	5	13				
	23	7	12				
	24	9.5	14				
	25	6.5	14				
	26	5	13				

RING 34f

Diametres:		Inside	Outside	Average
	North-South	3.99m	4.60m	4.30m
	Northeast - Southwest	4.25m	4.83m	4.54m
	East-West	3.80m	4.50m	4.15m
	Southeast-Northwest	4.08m	4.66m	4.37m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	12	14	W	30	26.5	17
	2	30.5	20		31	12	15
NE	3	7	15		32	5.5	11
	4	8.5	15		33	6.5	14
	5	12.5	18		34	2	9
	6	5.5	14		35	8	14
	7	4	15	NW	36	24.5	15
	8	6.5	14		37	8.5	13
	9	22.5	18		38	17	13
E	10	6	14		39	3.5	13
	11	9	16				
	12	17.5	15				
	13	20	15				
SE	14	23	19				
	15	16	17				
	16	35	26				
S	17	15	16				
	18	15.5	16				
	19	13	17				
	20	18	15				
	21	18	15				
	22	18	17				
	23	16	14				
	24	12.5	15				
SW	25	10	16				
	26	22.5	16				
	27	19.5	18				
	28	7	16				
	29	21	20				

RING 34h

Diametres:		Inside	Outside	Average
	North-South	4.58m	5.49m	5.04m
	Northeast - Southwest	5.22m	6.16m	5.69m
	East-West	4.86m	6.00m	5.43m
	Southeast-Northwest	5.76m	5.68m	5.72m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	12	12	S	36	9	17
	2	4	11		37	5	11
	3	9	12		38	4	11
	4	6.5	12		39	15	17
	5	4.5	14		40	10.5	15
NE	6	4	11		41	10	14
	7	3	9	SW	42	4.5	8
	8	4	6		43	11.5	15
	9	7.5	12		44	11.5	12
	10	5.5	13		45	7.5	14
	11	5	12	W	46	27	16
	12	6	14		47	18	18
	13	7	15		48	20	16
E	14	10.5	14		49	5	12
	15	10	15		50	6.5	17
	16	8.5	15	NW	51	13.5	16
	17	16.5	18		52	4.5	11
	18	8	16		53	8	18
	19	9	15		54	15	18
	20	21	16		55	3	14
	21	17.5	19		56	5	12
SE	22	22	11		57	11.5	17
	23	21	19		58	2.5	9
	24	9.5	12		59	8	17
	25	11	16				
	26	12	10				
	27	7	15				
S	28	12	16				
	29	11	16				
	30	13	15				
	31	18	19				
	32	5.5	17				
	33	6	13				
	34	11.5	18				
	35	14	18				

RING 34i

		Inside	Outside	Average
Diametres:	North-South	4.30m	5.30m	4.80m
	Northeast - Southwest	4.20m	5.26m	4.73m
	East-West	4.00	5.00m	4.50m
	Southeast-Northwest	3.57m	4.56m	4.06m

ROCK COUNTS, WEIGHTS, AND DEPTHS BY SECTOR

Sector	Count	Weight (kg)	Depth (cmBS)	Sector	Count	Weight (kg)	Depth (cmBS)
N	1	7.5	14	SW	36	13.5	16
	2	10	19	W	37	5.5	10
	3	11	15		38	13.5	15
	4	12.5	16		39	16	14
NE	5	13	18		40	6.5	17
	6	10.5	15		41	13.5	18
	7	7	16		42	21.5	19
	8	8	12	NW	43	8	13
E	9	8.5	14		44	7.5	17
	10	6.5	17		45	5.5	17
	11	6	15		46	14.5	16
	12	6	16		47	7.5	15
SE	13	12.5	13				
	14	3.5	13				
	15	9	14				
	16	7.5	13				
	17	5.5	13				
	18	5	15				
	19	9.5	13				
	20	5	14				
	21	12	15				
S	22	19	18				
	23	16	16				
	24	16.5	13				
	25	15.5	15				
	26	18.5	16				
	27	3.5	17				
	28	19	17				
	29	21.5	17				
	30	6	15				
SW	31	22	15				
	32	27	18				
	33	5.5	17				
	34	9	16				
	35	15	17				

Ring 3a: Level 1

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary													1									1
Secondary																						
Waste Flakes																						
Shatter																						
Block Fracture																						
Secondary Flakes																						
Thinning																						
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total													1									1

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Ring 3a: Levels 3 - 5

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary														1								1
Secondary																						
Waste Flakes																						
Shatter																						
Block Fracture													1									1
Secondary Flakes	1		1											3								5
Thinning	2		1							2												5
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	3		2							2			1	4								12

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Ring 3b: Level 2	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces	1																					1
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes	4																					4
Cores/Core Frags.																						
Decortication Flakes																						
Primary	3												1									4
Secondary	2												2									
Waste Flakes																						
Shatter	18											1	1	1								21
Block Fracture	1																					1
Secondary Flakes	1																					1
Thinning	2		1								1											4
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation	1																					1
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	33		1								1	1	2	1								39

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 3d: All Levels			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes	1																					1
Utilized Flakes									1													1
Cores/Core Frags.																						
Decortication Flakes																						
Primary	1											2										3
Secondary	3									1		1										5
Waste Flakes																						
Shatter	2		1																			3
Block Fracture																						
Secondary Flakes	5		1																			6
Thinning			1																			1
Resharpening																						
Retouch									1													
Edge Preparation																						
Core Rejuvenation	1																					1
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils	2																					2
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	15		3						1	2		3										24

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Etherington	Swan River	Montana	Avon														
Ring 4j: Levels 1 - 3																						
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes	1																					1
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary												1										1
Secondary	2																					2
Waste Flakes																						
Shatter	2		1																			3
Block Fracture																						
Secondary Flakes	13									1												14
Thinning	2		1																			3
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles	1																					1
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	21		2							1		1										25

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.		CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 4j: Levels 4 - 8		Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																					
Bifaces																					
Piece Esquilles/Wedges					1																1
Unifaces																					
Chopping Tools																1					1
Scrapers (End/Side)																					
Retouched Flakes		1						1													2
Utilized Flakes	1																				1
Cores/Core Frags.																					
Decortication Flakes																					
Primary	2	1																			3
Secondary	2	1									3										6
Waste Flakes																					
Shatter	1	1											3								5
Block Fracture																					
Secondary Flakes	3	3									5										11
Thinning		2				1			1		1										5
Resharpening																					
Retouch																					
Edge Preparation																					
Core Rejuvenation	2																				2
Core Preparation																					
Indeterminate																					
Hammerstones/Anvils																					
Split Pebbles/Cobbles																					
Gaming Piece																					
Potsherds																					
Flaked Cobble																					
Grinding Stone																					
Indeterminate																					
Total	11	9			1	1		1	1		9		3			1					37

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 4K: All Levels			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces	1																					1
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	1																					1
Scrapers (End/Side)																						
Retouched Flakes													1									1
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	3													1								4
Secondary																						
Waste Flakes																						
Shatter			1																			1
Block Fracture																						
Secondary Flakes	3		1											2								6
Thinning	1																					1
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	9		2										1	3								15

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

Ring 321: Levels 1 - 3

	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	1		1																			2
Scrapers (End/Side)																						
Retouched Flakes			2				1															3
Utilized Flakes			1																			1
Cores/Core Frags.																						
Decortication Flakes																						
Primary	2		12																			14
Secondary	7		4																			11
Waste Flakes																						
Shatter	2		7										1									10
Block Fracture																						
Secondary Flakes	10		57									2				2						71
Thinning	37		38																			75
Resharpening																						
Retouch	15		29							2												46
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles														1								1
Gaming Piece																						
Potsherds																		1				1
Flaked Cobble																						
Grinding Stone																						
Indeterminate																			3			3
Total	74		151				1			2		2	1	1		2		1	3			238

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 33a: Levels 1 - 4			Ind.	Pebble	Etherington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)			1																			1
Retouched Flakes																						
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	3																					3
Secondary	4																					4
Waste Flakes																						
Shatter	1		1																			2
Block Fracture																						
Secondary Flakes	6									1												7
Thinning																						
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles	1																					1
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	15		2							1												18

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 33f: All Levels			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	1													1								2
Scrapers (End/Side)			1				1															2
Retouched Flakes																						
Utilized Flakes	1																					1
Cores/Core Frags.	1																					1
Decortication Flakes																						
Primary	2													1								3
Secondary	1											1										2
Waste Flakes																						
Shatter	3		2									1		21								27
Block Fracture																						
Secondary Flakes	5		1									4										10
Thinning	2		3								3			1								9
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	16		7				1				3	6		24								57

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Ring 331: All Levels	QTZITE	S.A.	Ind.	Pebble	CHERT Ether- ington	Swan River	Montana	Avon	KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Projectile Points[1]			1																			1
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	2																					2
Scrapers (End/Side)										1												1
Retouched Flakes	1		1														1			1		4
Utilized Flakes																						
Cores/Core Frags.	1																					1
Decortication Flakes																						
Primary	3													1								4
Secondary	6													1								7
Waste Flakes																						
Shatter			1											1								2
Block Fracture																						
Secondary Flakes	7		1							2				1								11
Thinning			1							1												2
Resharpening																						
Retouch			1																			1
Edge Preparation																						
Core Rejuvenation	1																					1
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone	1																					1
Indeterminate																						
Total	22		6							4				4			1			1		38

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.		CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 33j: Levels 1 - 4		Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																					
Bifaces																					
Piece Esquilles/Wedges																					
Unifaces																					
Chopping Tools																					
Scrapers (End/Side)																					
Retouched Flakes																					
Utilized Flakes		1																			1
Cores/Core Frags.	1																				1
Decortication Flakes																					
Primary	2	1																			3
Secondary	1								1												2
Waste Flakes																					
Shatter																					
Block Fracture																					
Secondary Flakes	6	2									1										9
Thinning	1	1							2						1						5
Resharpening																					
Retouch																					
Edge Preparation																					
Core Rejuvenation																					
Core Preparation																					
Indeterminate																					
Hammerstones/Anvils																					
Split Pebbles/Cobbles																					
Gaming Piece																					
Potsherds																					
Flaked Cobble																					
Grinding Stone																					
Indeterminate																					
Total	11	5							3		1				1						21

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Ring 33j: Levels 5 - 6																						
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																1						1
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	1																					1
Secondary	2		1																			3
Waste Flakes																						
Shatter														1								1
Block Fracture																						
Secondary Flakes	6		1											1								8
Thinning			1							1					1							3
Resharpening																						
Retouch			1																			1
Edge Preparation																						
Core Rejuvenation	1																					1
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles														1								1
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	10		4							1				3		2						20

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 34b: All			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes	1												1			1						3
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	1																					1
Secondary	2		1																			3
Waste Flakes																						
Shatter																						
Block Fracture																						
Secondary Flakes	1		1																			2
Thinning	1																					1
Resharpening																						
Retouch										1												1
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	6		2							1			1			1						11

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Ring 34c: All Levels	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
			Ind.	Pebble	Etherington	Swan River	Montana	Avon													
Projectile Points[1]																					
Bifaces																					
Piece Esquilles/Wedges																					
Unifaces																					
Chopping Tools																					
Scrapers (End/Side)			1																		1
Retouched Flakes																					
Utilized Flakes																					
Cores/Core Frags.																					
Decortication Flakes																					
Primary	1																				1
Secondary	1		1																		2
Waste Flakes																					
Shatter																					
Block Fracture																					
Secondary Flakes	1		1																		2
Thinning																					
Resharpening																					
Retouch																					
Edge Preparation																					
Core Rejuvenation																					
Core Preparation																					
Indeterminate																					
Hammerstones/Anvils																					
Split Pebbles/Cobbles																					
Gaming Piece																					
Potsherds																					
Flaked Cobble																					
Grinding Stone																					
Indeterminate																					
Total	3		3																		6

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

Ring 34e: All Levels

	QTZITE	S.A.	CHERT Ind.	Pebble	Ether-ington	Swan River	Montana	Avon	KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Projectile Points[1]																						
Bifaces			1																			1
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	3																					3
Secondary	3																					3
Waste Flakes																						
Shatter																						
Block Fracture																						
Secondary Flakes	2																					2
Thinning	1																					1
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	9		1																			10

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.			CHERT				KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 34f: All Levels			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes																						
Utilized Flakes										1												1
Cores/Core Frags.																						
Decortication Flakes																						
Primary	1		2																			3
Secondary	2		1											1								4
Waste Flakes																						
Shatter	1		1									1		1								4
Block Fracture													3									3
Secondary Flakes	6		3											2								11
Thinning			3							1												4
Resharpening																						
Retouch																						
Edge Preparation													1									1
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	10		10							2		1	4	4								31

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[1] Includes fragments

QTZITE = QUARTZITE
S.A. = SILICIFIED ASH
Ind. = Indeterminate Types
KRF = KNIFE RIVER FLINT

CHAL. = CHALCEDONY
S.S. = SILICIFIED SILTSTONE
PfW. = PETRIFIED WOOD
QTZ. = QUARTZ

GRAN. = GRANITE
OBS. = OBSIDIAN
ARG. = ARGILLITE
IGN. = IGNIMBRITE

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 34h: All Levels			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]																						
Bifaces	1																					1
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools	1																					1
Scrapers (End/Side)			1																			1
Retouched Flakes																						
Utilized Flakes													1									1
Cores/Core Frags.																						
Decortication Flakes																						
Primary			1										1									2
Secondary	1																					1
Waste Flakes																						
Shatter			2							2		1		1								6
Block Fracture																						
Secondary Flakes																						
Thinning	1		1							2												4
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation																						
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	4		5							4		1	2	1								17

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

	QTZITE	S.A.	CHERT						KRF	CHAL.	BROWN CHAL.	S.S.	PfW.	QTZ.	GRAN.	OBS.	ARG.	POTTERY	IGN.	SCHIST	OCHRE	TOTAL
Ring 341: All Levels			Ind.	Pebble	Ether-ington	Swan River	Montana	Avon														
Projectile Points[1]			1									1										2
Bifaces																						
Piece Esquilles/Wedges																						
Unifaces																						
Chopping Tools																						
Scrapers (End/Side)																						
Retouched Flakes	1																					1
Utilized Flakes																						
Cores/Core Frags.																						
Decortication Flakes																						
Primary	1		1																			2
Secondary	1		2											1								4
Waste Flakes																						
Shatter			2											1								3
Block Fracture																						
Secondary Flakes	7		3									1		1		1						13
Thinning	4		4							1				1								10
Resharpening																						
Retouch																						
Edge Preparation																						
Core Rejuvenation	1																					1
Core Preparation																						
Indeterminate																						
Hammerstones/Anvils																						
Split Pebbles/Cobbles																						
Gaming Piece																						
Potsherds																						
Flaked Cobble																						
Grinding Stone																						
Indeterminate																						
Total	15		13							1		2		4		1						36

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[1] Includes fragments

QTZITE = QUARTZITE	CHAL. = CHALCEDONY	GRAN. = GRANITE
S.A. = SILICIFIED ASH	S.S. = SILICIFIED SILTSTONE	OBS. = OBSIDIAN
Ind. = Indeterminate Types	PfW. = PETRIFIED WOOD	ARG. = ARGILLITE
KRF = KNIFE RIVER FLINT	QTZ. = QUARTZ	IGN. = IGNIMBRITE

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